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**Nagura et al.**

(10) **Patent No.: US 9,162,590 B2**
(45) **Date of Patent: Oct. 20, 2015**

(54) **SEAT SLIDE APPARATUS FOR VEHICLE**

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(73) Assignee: **AISIN SEIKI KABUSHIKI KAISHA**, Kariya-shi (JP)

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(22) Filed: **Jul. 11, 2013**

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(30) **Foreign Application Priority Data**

Jul. 17, 2012 (JP) ..... 2012-158776

(51) **Int. Cl.**

| | |
|---|---|
| ***F16M 13/00*** | (2006.01) |
| ***B60N 2/08*** | (2006.01) |
| ***B60N 2/07*** | (2006.01) |
| ***B60N 2/12*** | (2006.01) |
| *B60N 2/44* | (2006.01) |

(52) **U.S. Cl.**

CPC ..... ***B60N 2/0837*** (2013.01); ***B60N 2/07*** (2013.01); ***B60N 2/0705*** (2013.01); ***B60N 2/0715*** (2013.01); ***B60N 2/0843*** (2013.01); ***B60N 2/12*** (2013.01); *B60N 2002/4455* (2013.01)

(58) **Field of Classification Search**

CPC ..... B60N 2/08; B60N 2/01715; B60N 2/12; B60N 2/0843

See application file for complete search history.

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*Primary Examiner* — Amy Sterling

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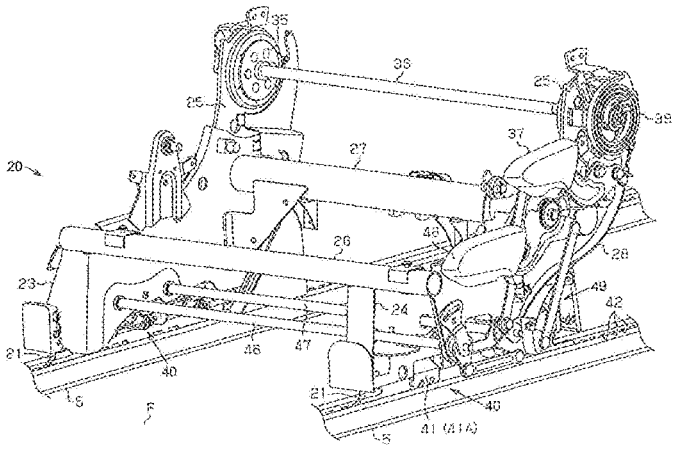
(57) **ABSTRACT**

A seat slide apparatus for a vehicle includes a second unlock mechanism rotating an unlock lever in a direction that unlocks a lock mechanism by pushing the unlock lever in accordance with a predetermined seat operation, an unlocked state retaining lever retaining the lock mechanism in an unlocked state cooperating with the second unlock mechanism by operating in conjunction with the second unlock mechanism, a first unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from the unlocked state by making contact with an operation body in accordance with movement of an upper rail relative to an lower rail, and a second unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from the unlocked state by pushing the unlocked state retaining lever in accordance with the operational input.

**14 Claims, 23 Drawing Sheets**



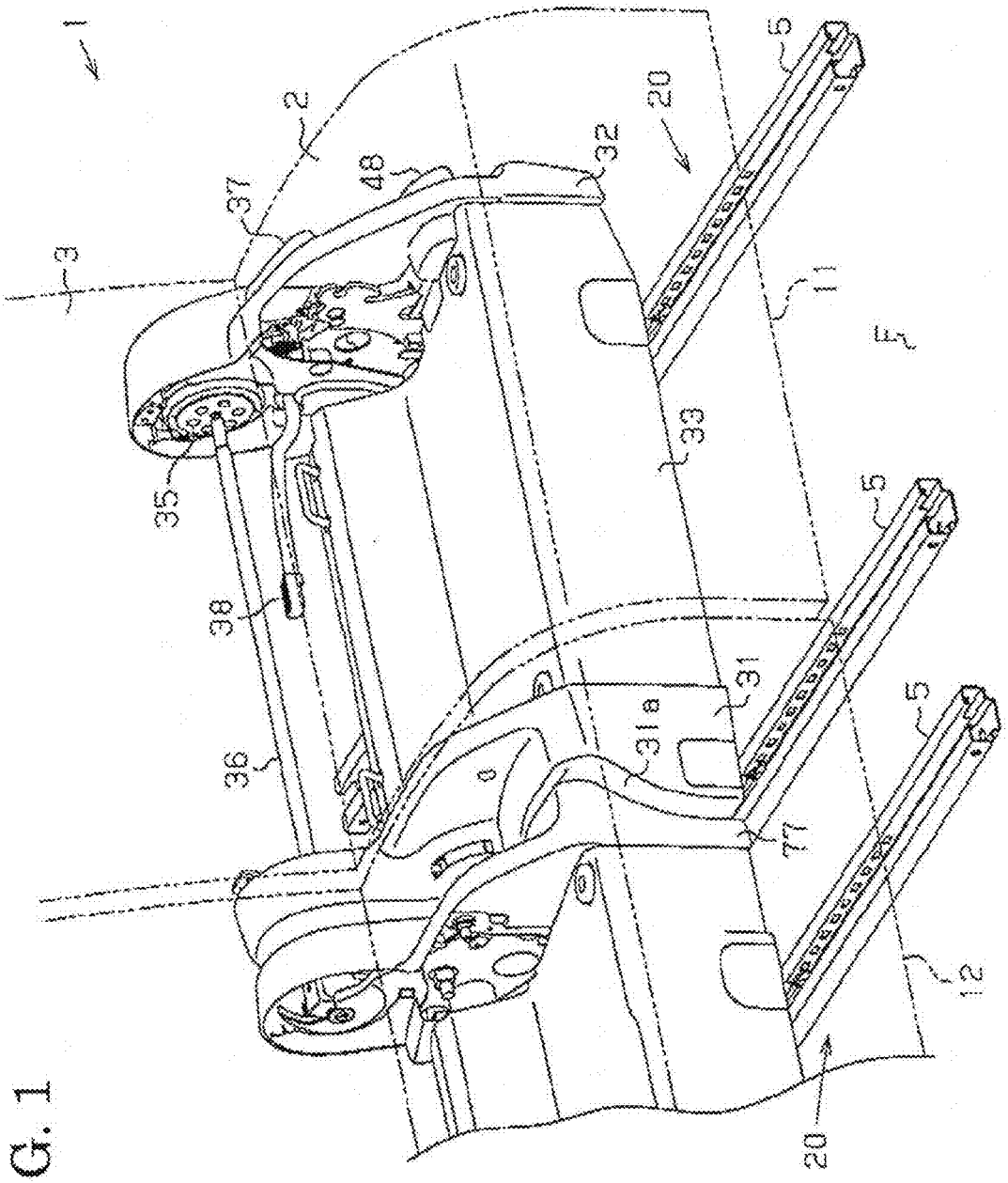



FIG. 1

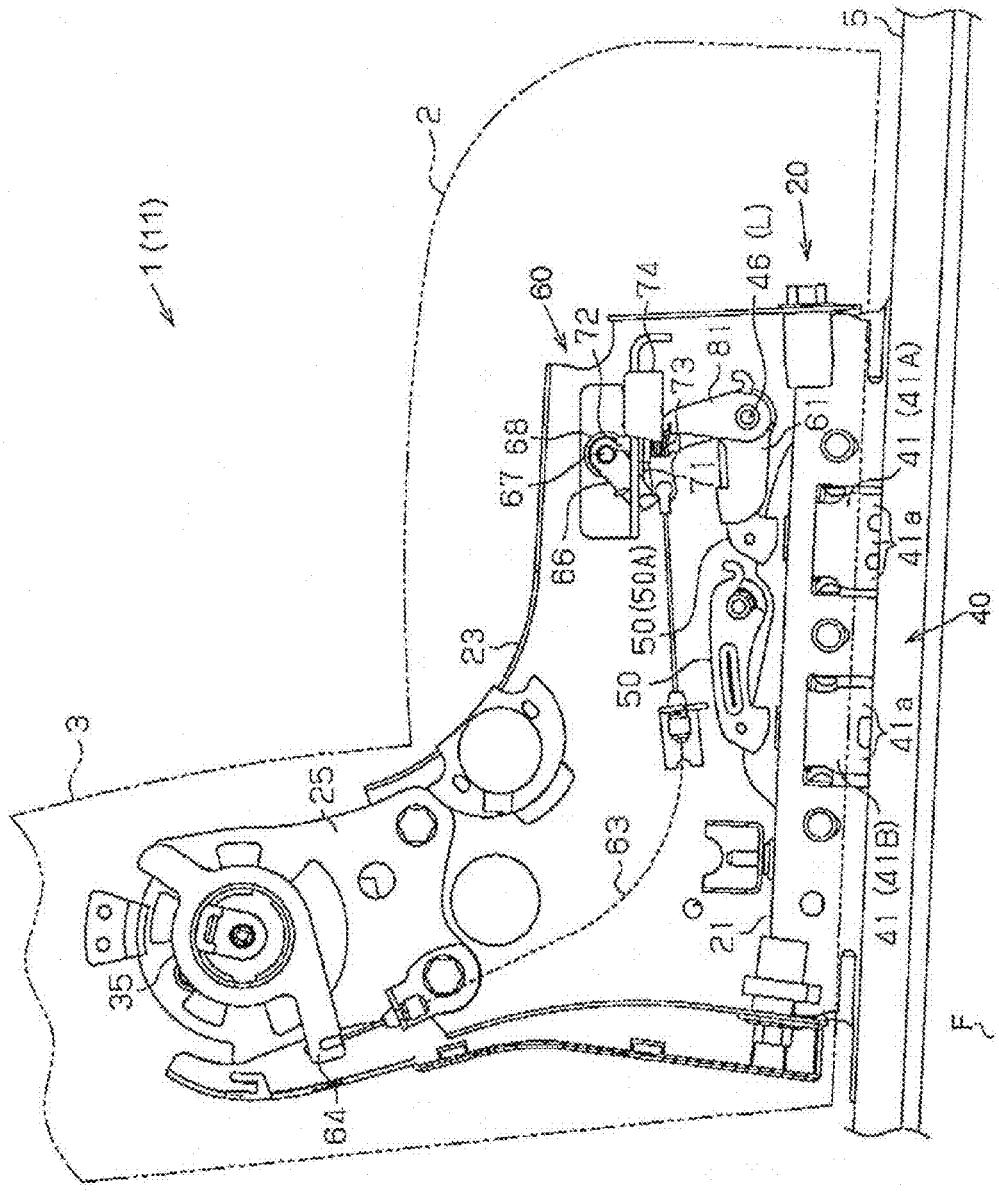

1 (11)
2
3
5
20
23
25
35
40
41 (41A)
41a
41 (41B)
46 (L)
50
50(50A)
60
61
63
64
66
67
68
71
72
73
74
81
21
F

FIG. 2

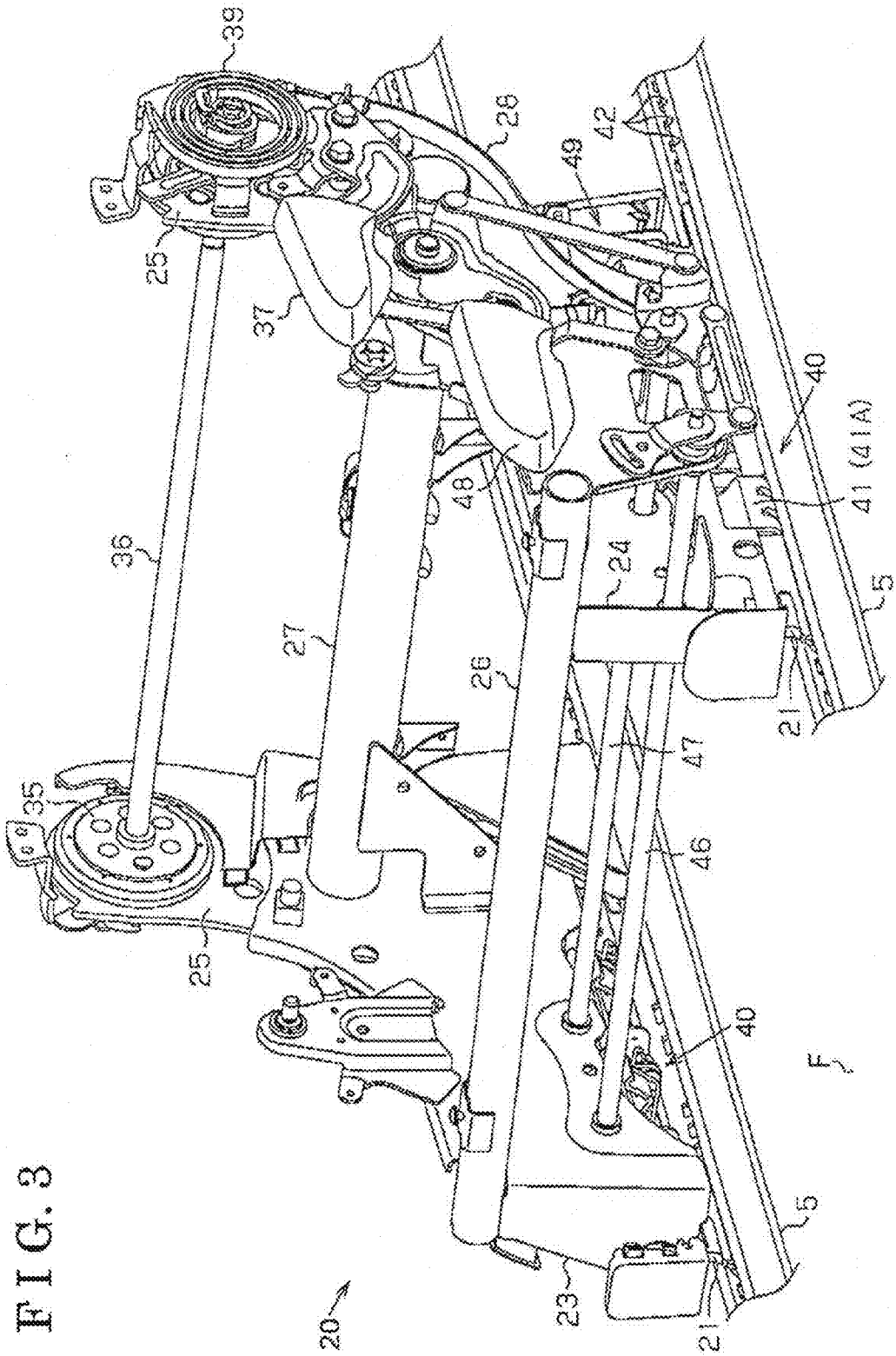

39
28
49
42
25
37
40
41 (41A)
48
36
24
5
27
26
21
47
35
46
25
40
F
5
23
21
20

FIG. 3

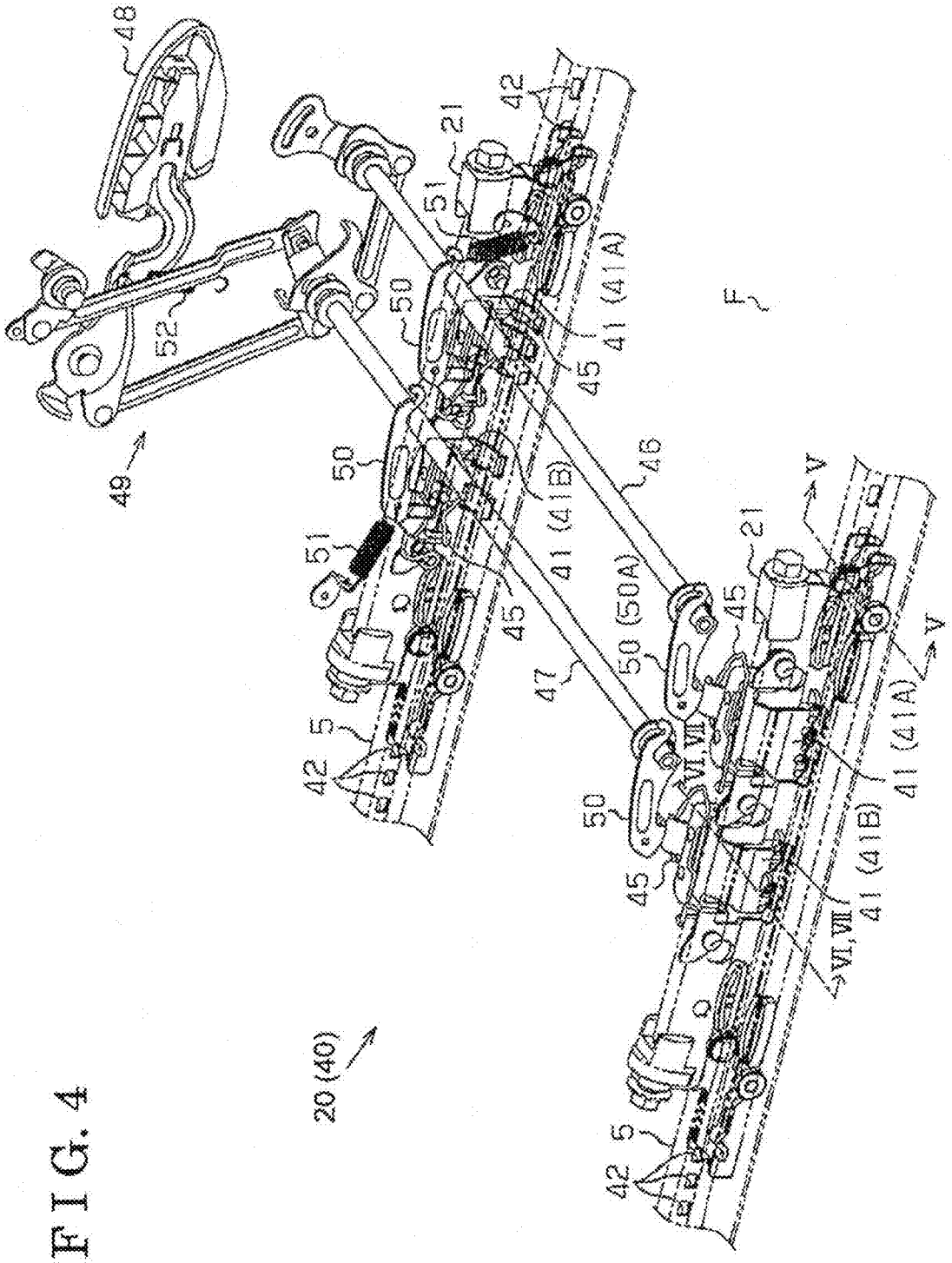

48
52
49
50
51
21
42
41 (41A)
45
F
46
41 (41B)
50 (50A)
47
V
V
VI, VII
VI, VII
5
20 (40)

FIG. 4

FIG. 5

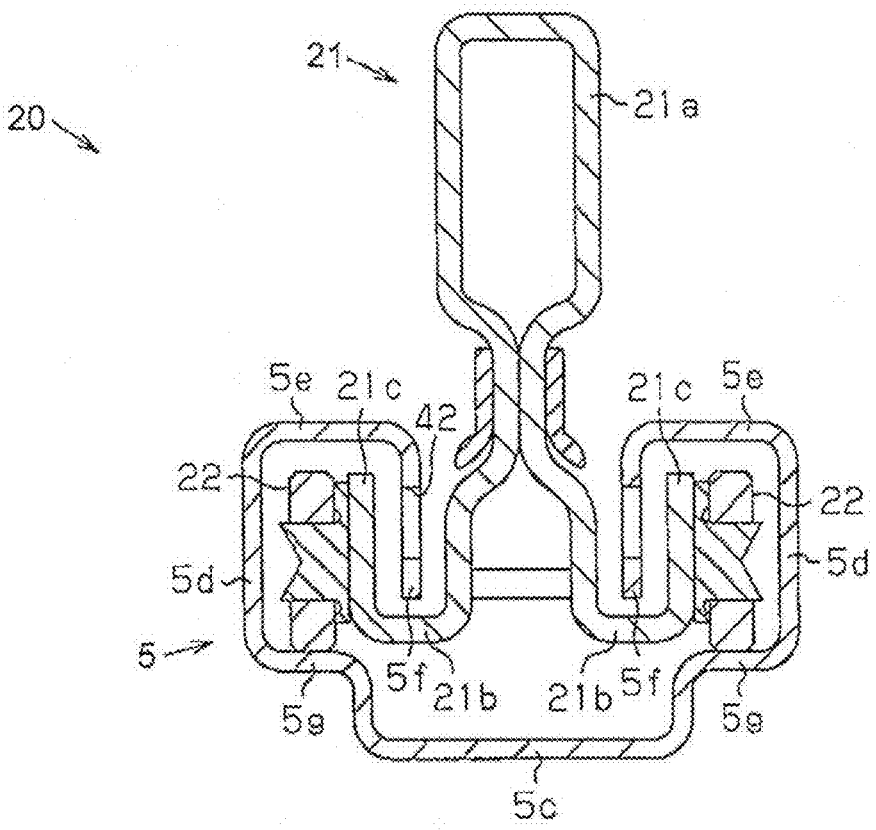


FIG. 6

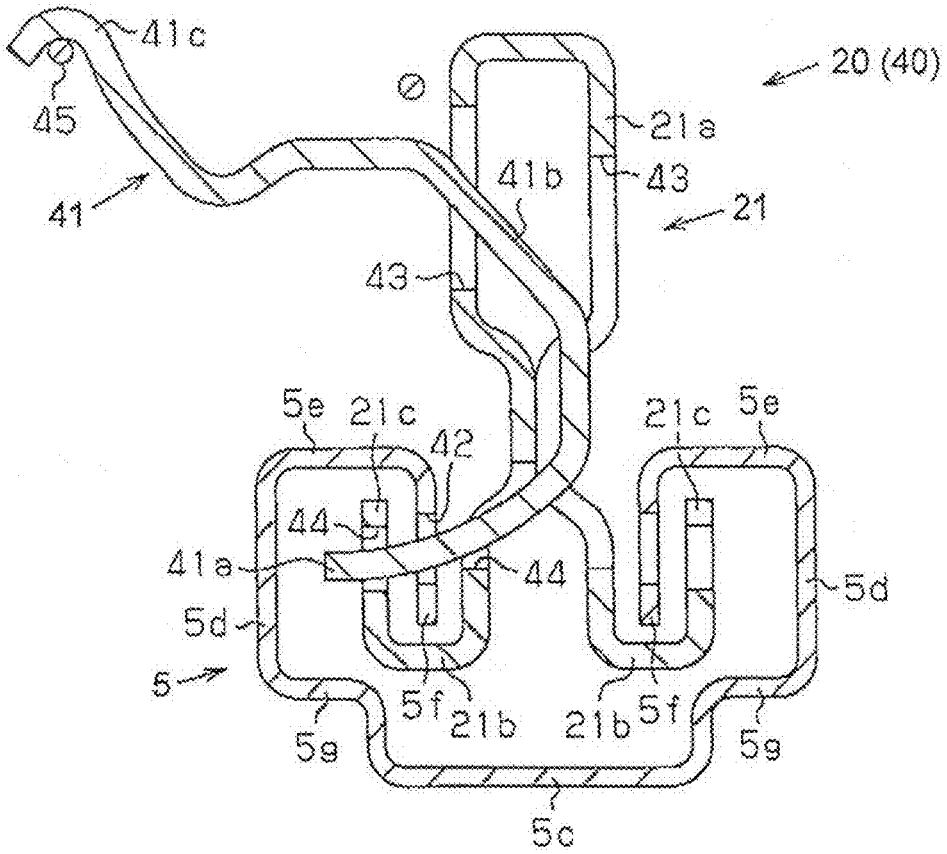

41c
45
41
20 (40)
21a
41b
43
21
43
5e
21c
42
21c
5e
44
41a
44
5d
5d
5
5f
21b
21b
5f
5g
5g
5c

FIG. 7

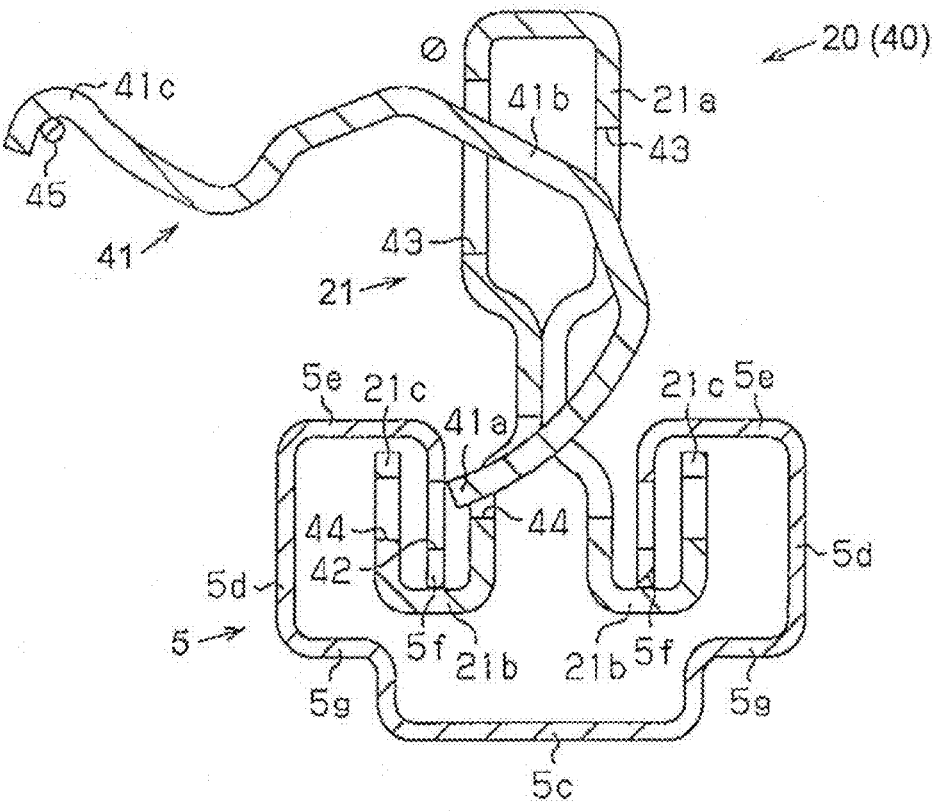

20 (40)
41c
41b
21a
43
45
41
43
21
5e
21c
41a
21c
5e
44
44
42
5d
5d
5
5f
21b
21b
5f
5g
5g
5c

FIG. 8

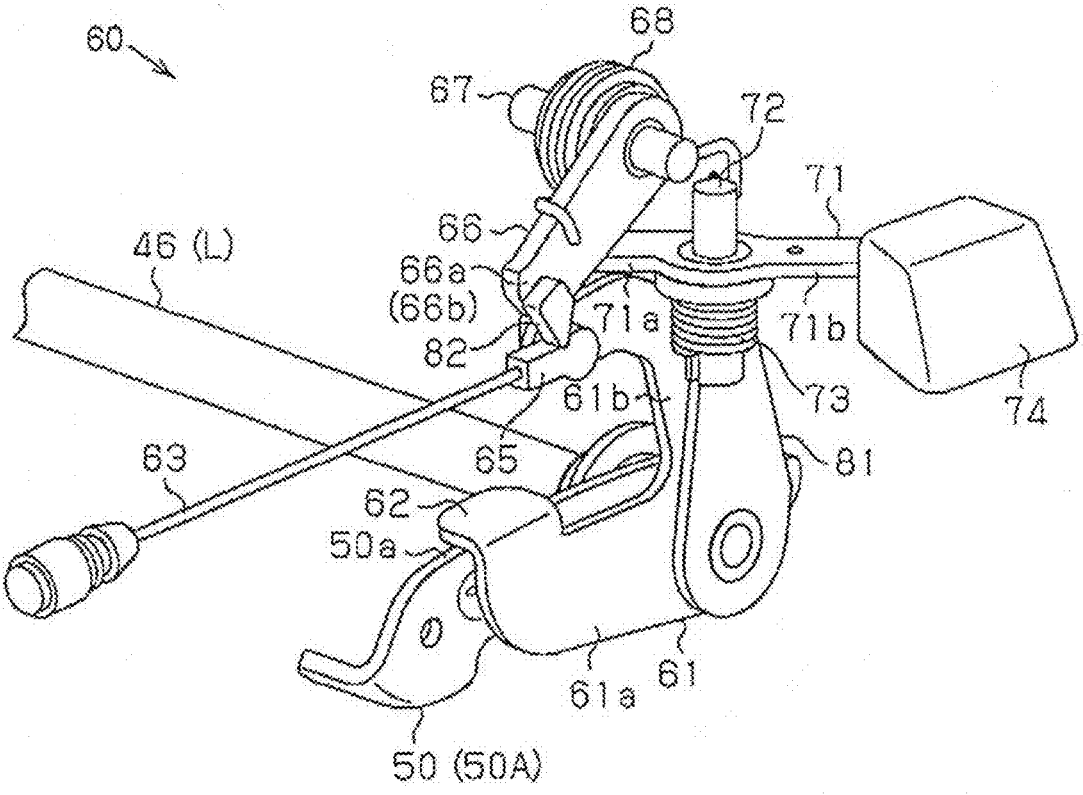

60
68
67
72
71
66
46 (L)
66a
(66b)
71a
71b
82
61b
73
74
63
65
81
62
50a
61a
61
50 (50A)

FIG. 9

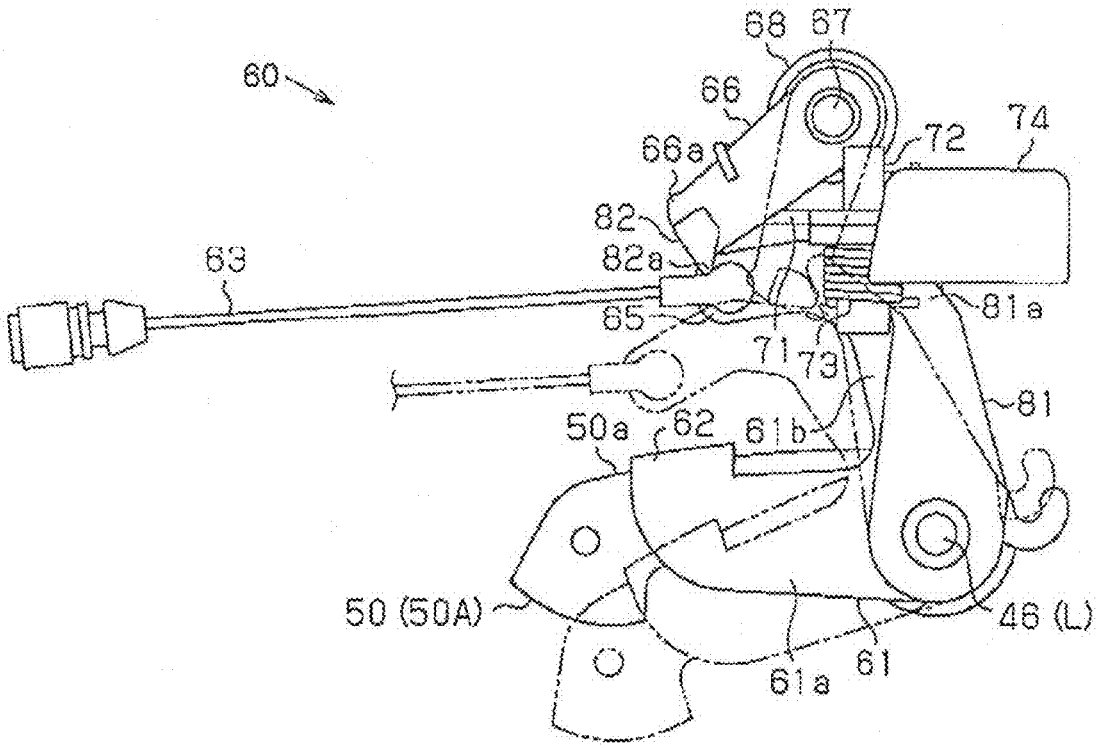

68
67
60
66
66a
72
74
82
82a
63
65
81a
71
73
81
50a
62
61b
50 (50A)
46 (L)
61a
61

FIG. 10A

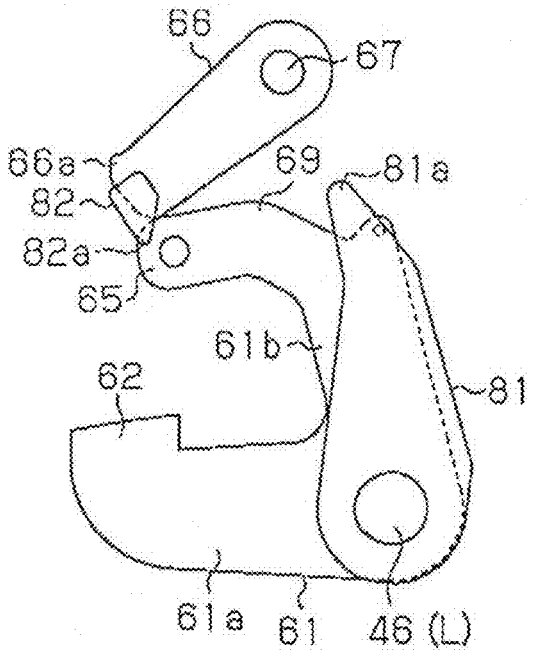



FIG. 10B

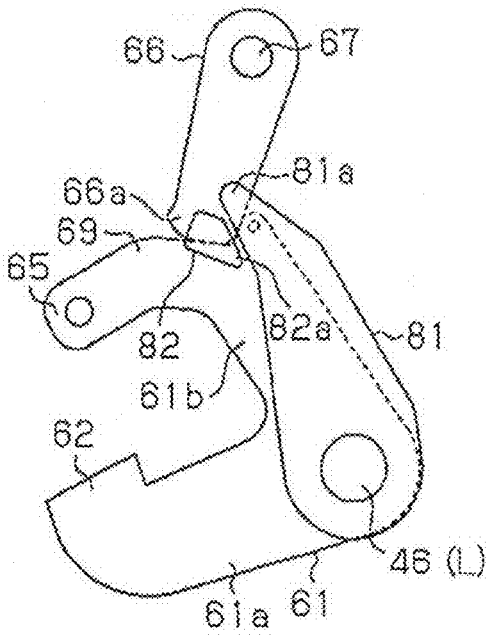


FIG. 11

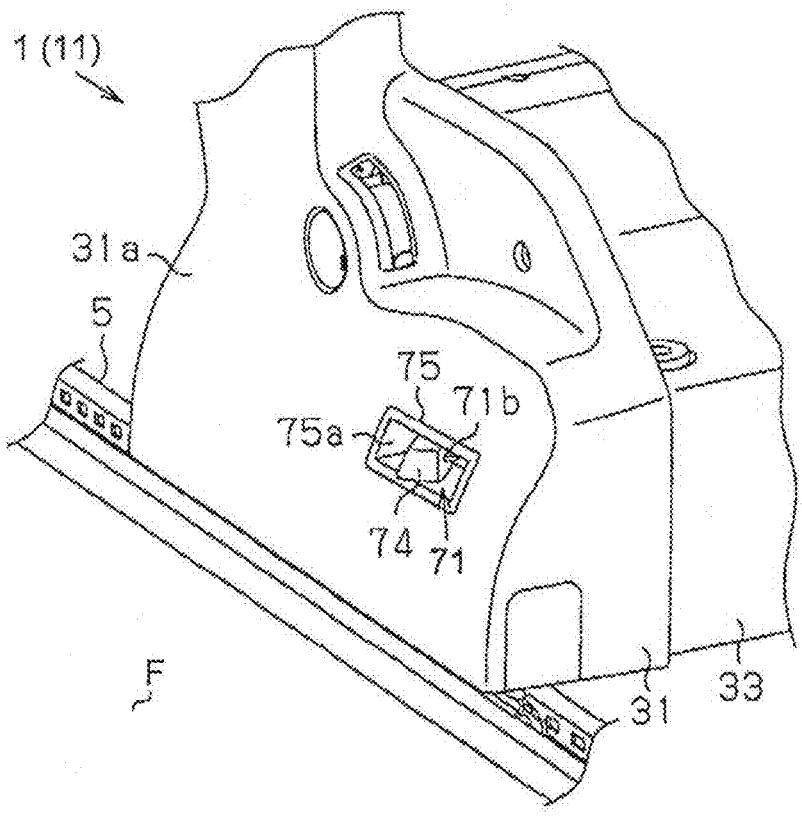


FIG. 12

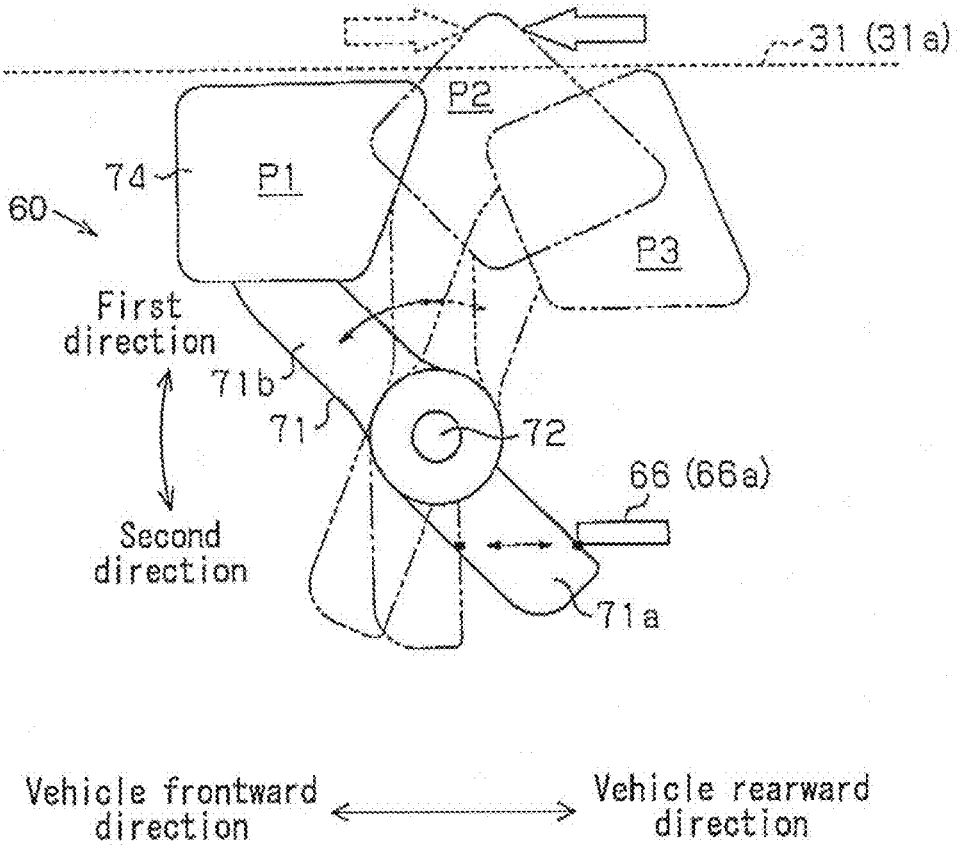

31 (31a)
P2
74
P1
60
P3
First direction
71b
71
72
66 (66a)
Second direction
71a
Vehicle frontward direction
Vehicle rearward direction

FIG. 13

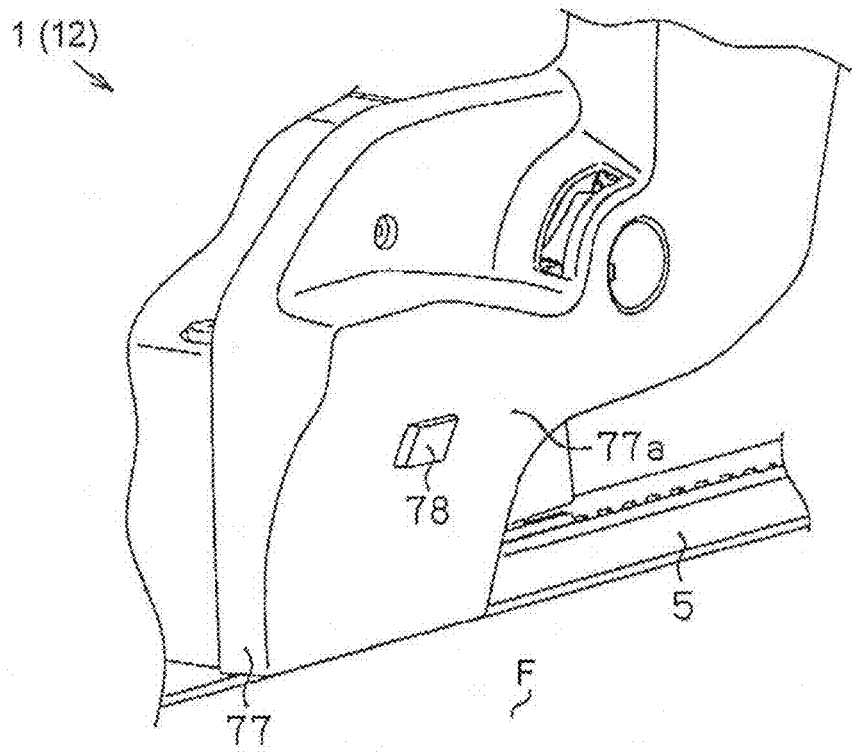


FIG. 14

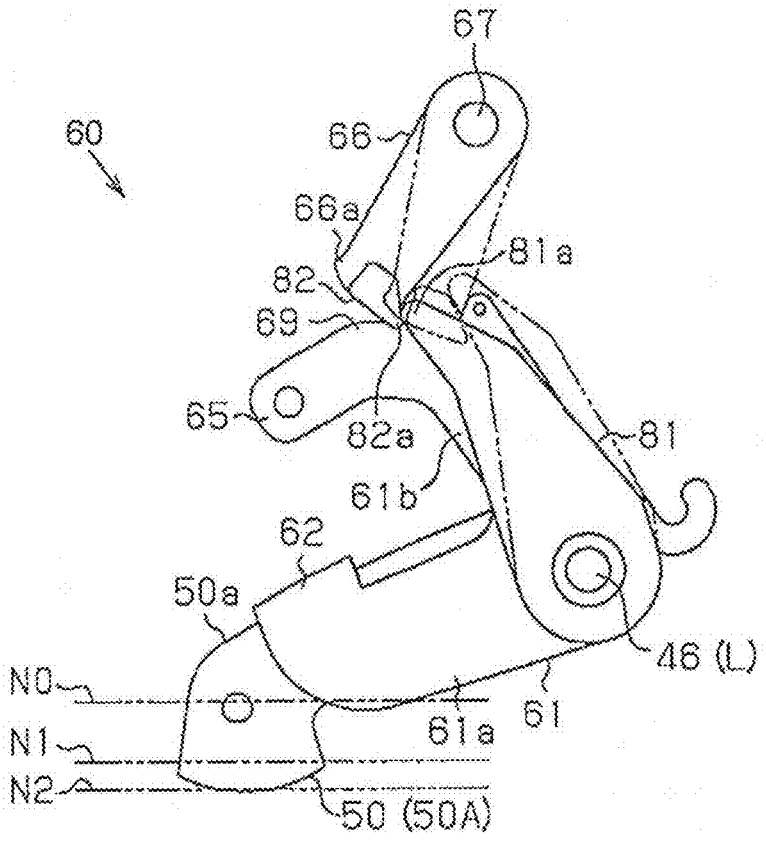

67
60
66
66a
81a
82
69
65
82a
81
61b
62
50a
46 (L)
N0
61
61a
N1
N2
50 (50A)

FIG. 15A

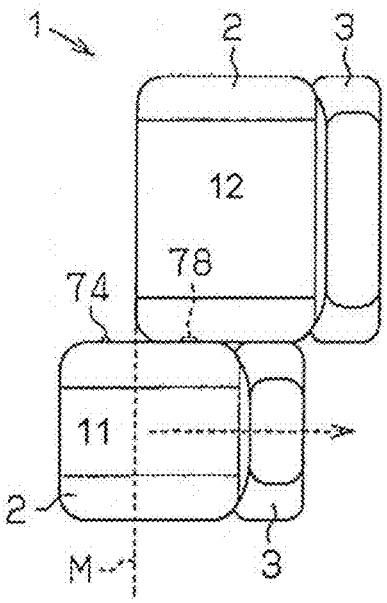
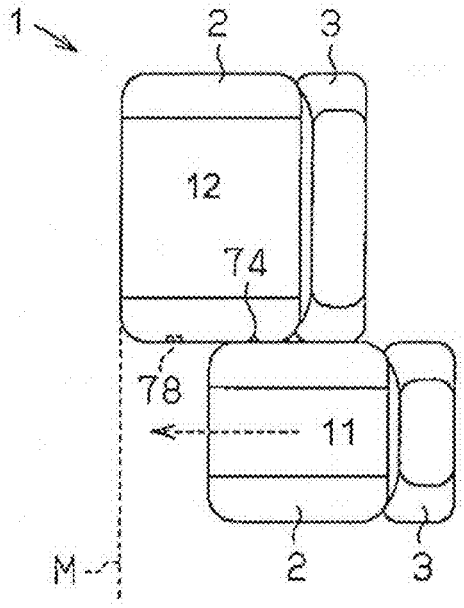



FIG. 15B



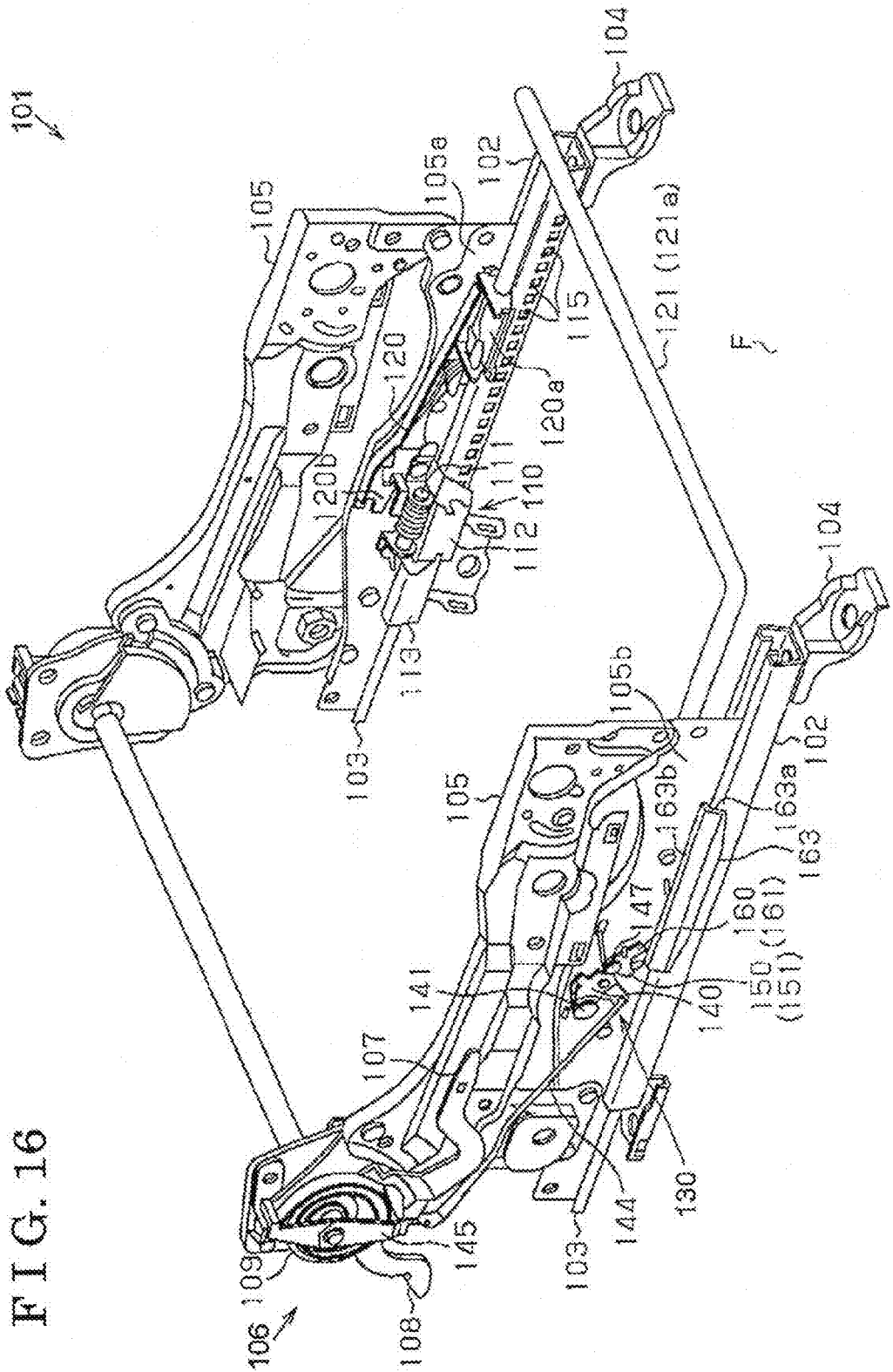

101
104
102
105a
105
121 (121a)
115
F
120
120a
120b
111
110
112
113
103
105b
163b
163a
163
147
160
150
(151)(161)
140
141
107
145
109
106
108
144
130

FIG. 16

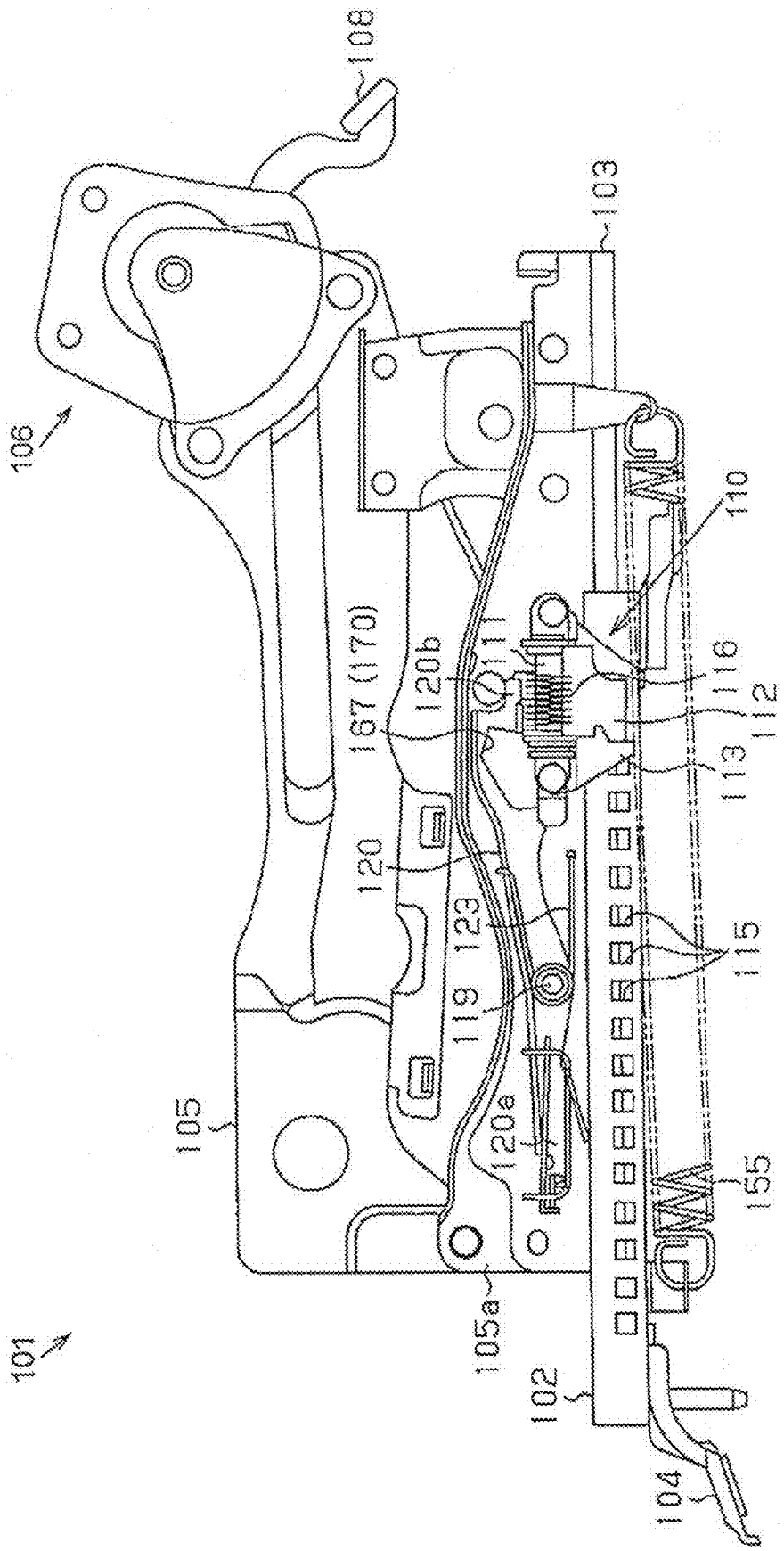

108
103
106
110
167 (170)
120b
111
116
112
113
120
123
115
119
105
120e
155
105a
102
104
101

FIG. 17

FIG. 18

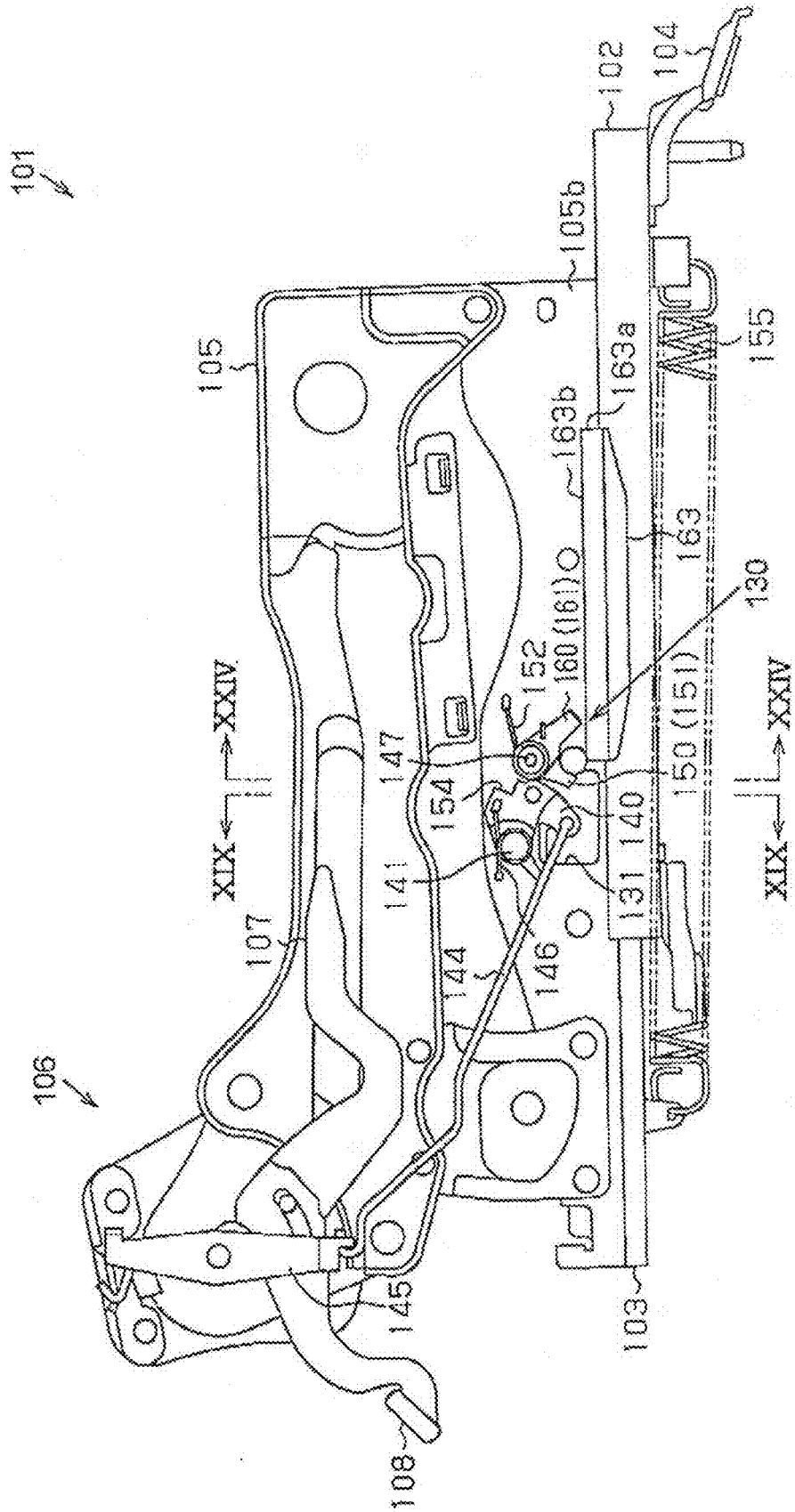

101
102
104
105b
105
163a
155
163b
163
130
160 (161)
152
147
154
150 (151)
140
131
141
107
144
146
106
145
103
108
XIX
XXIV
XIX
XXIV

FIG. 19

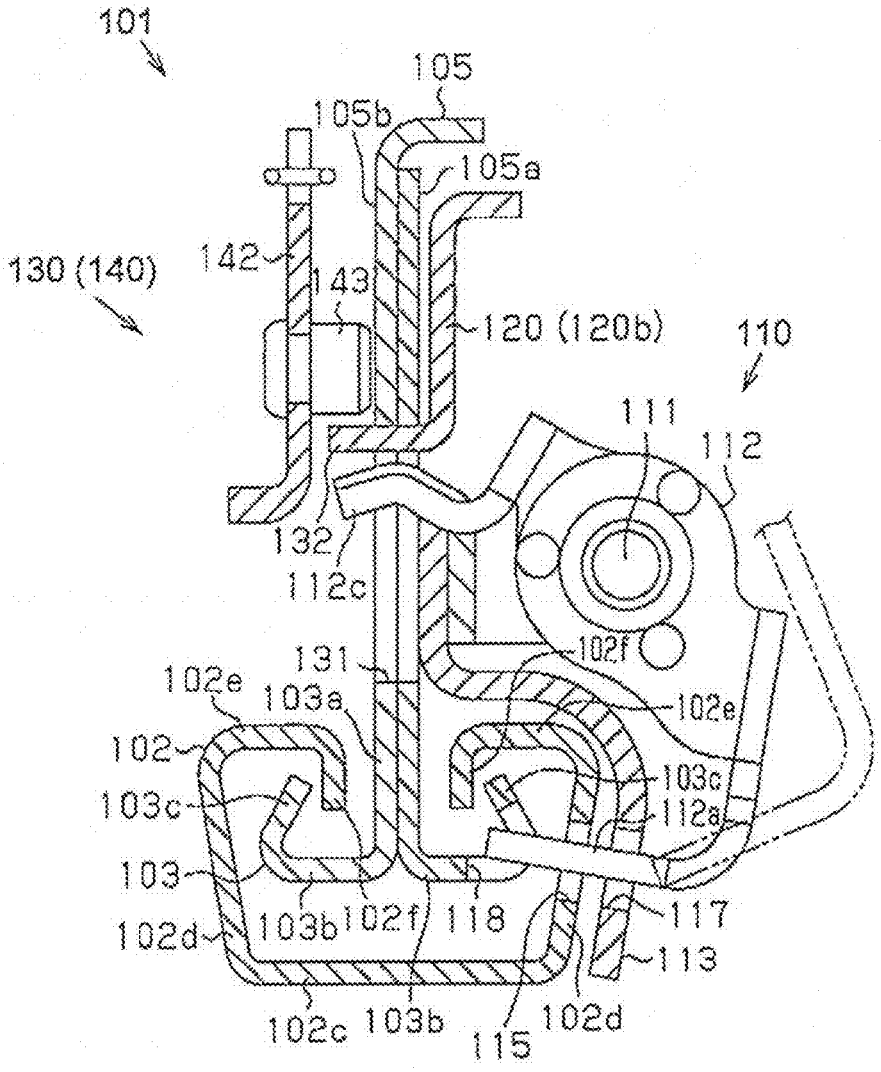

101
105
105b
105a
130 (140)
142
143
120 (120b)
110
111
112
132
112c
131
102f
102e
103a
102e
102
103c
103c
112a
103
102d
103b
102f
118
117
113
102c
103b
115
102d

FIG. 20

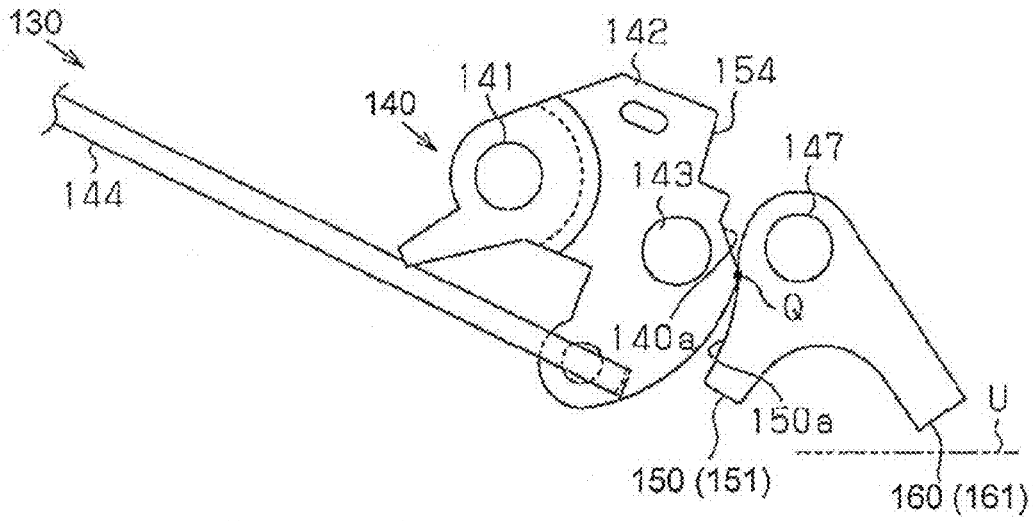



FIG. 21

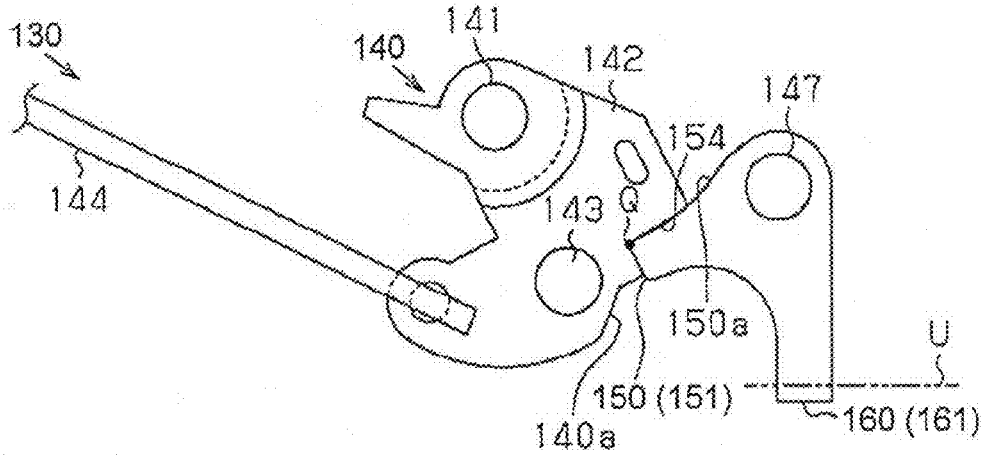



FIG. 22

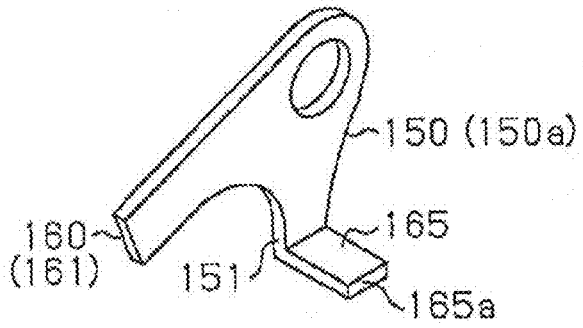


FIG. 23

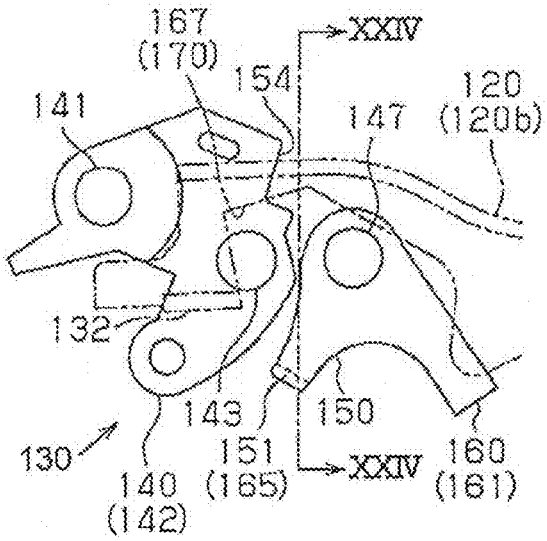



FIG. 24

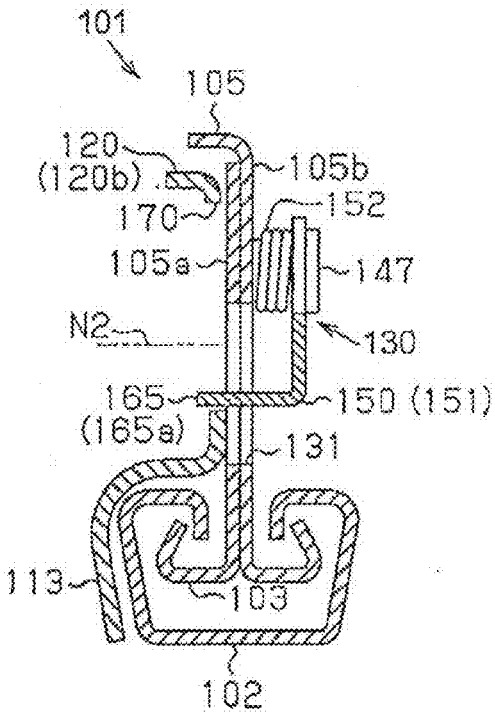



FIG. 25

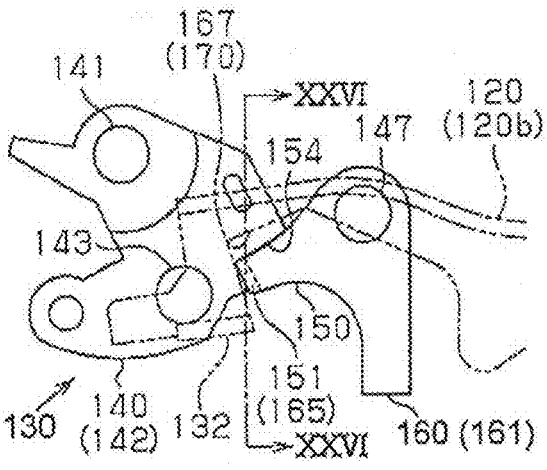



FIG. 26

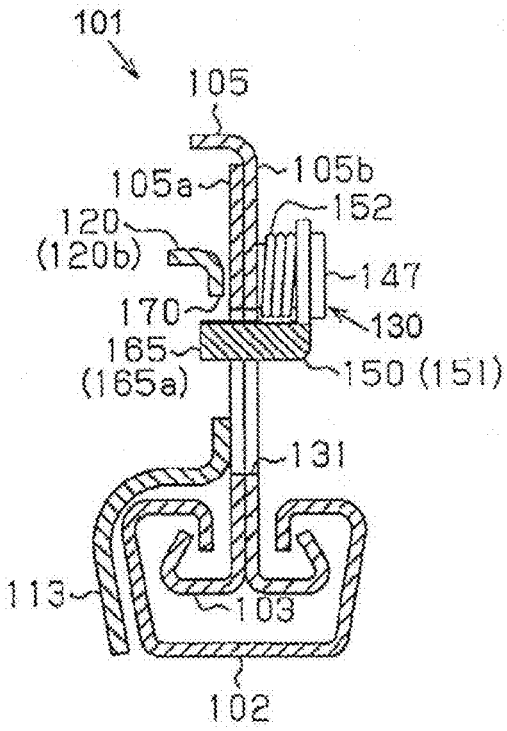


FIG. 27

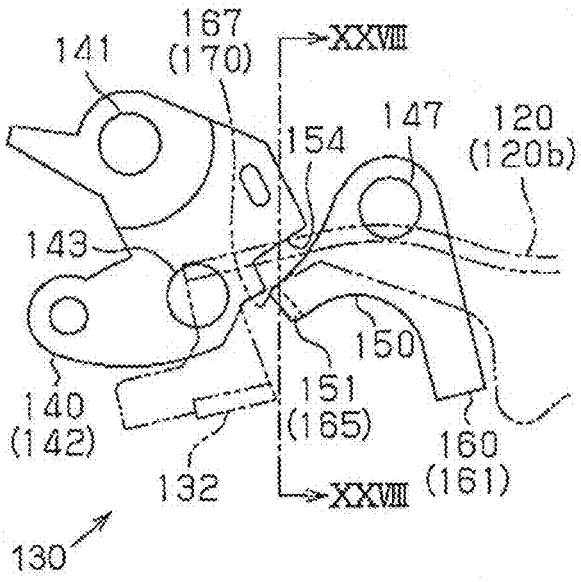

167
(170)
141
XXVIII
154
147
120
(120b)
143
150
151
(165)
140
(142)
160
(161)
132
XXVIII
130

FIG. 28

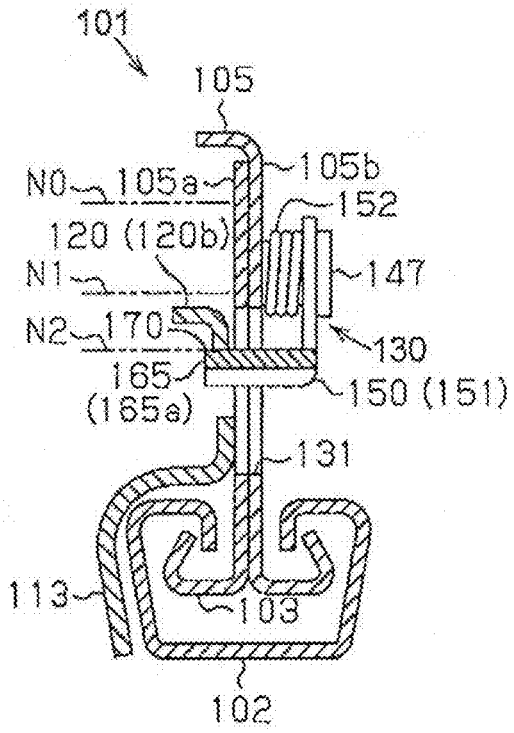
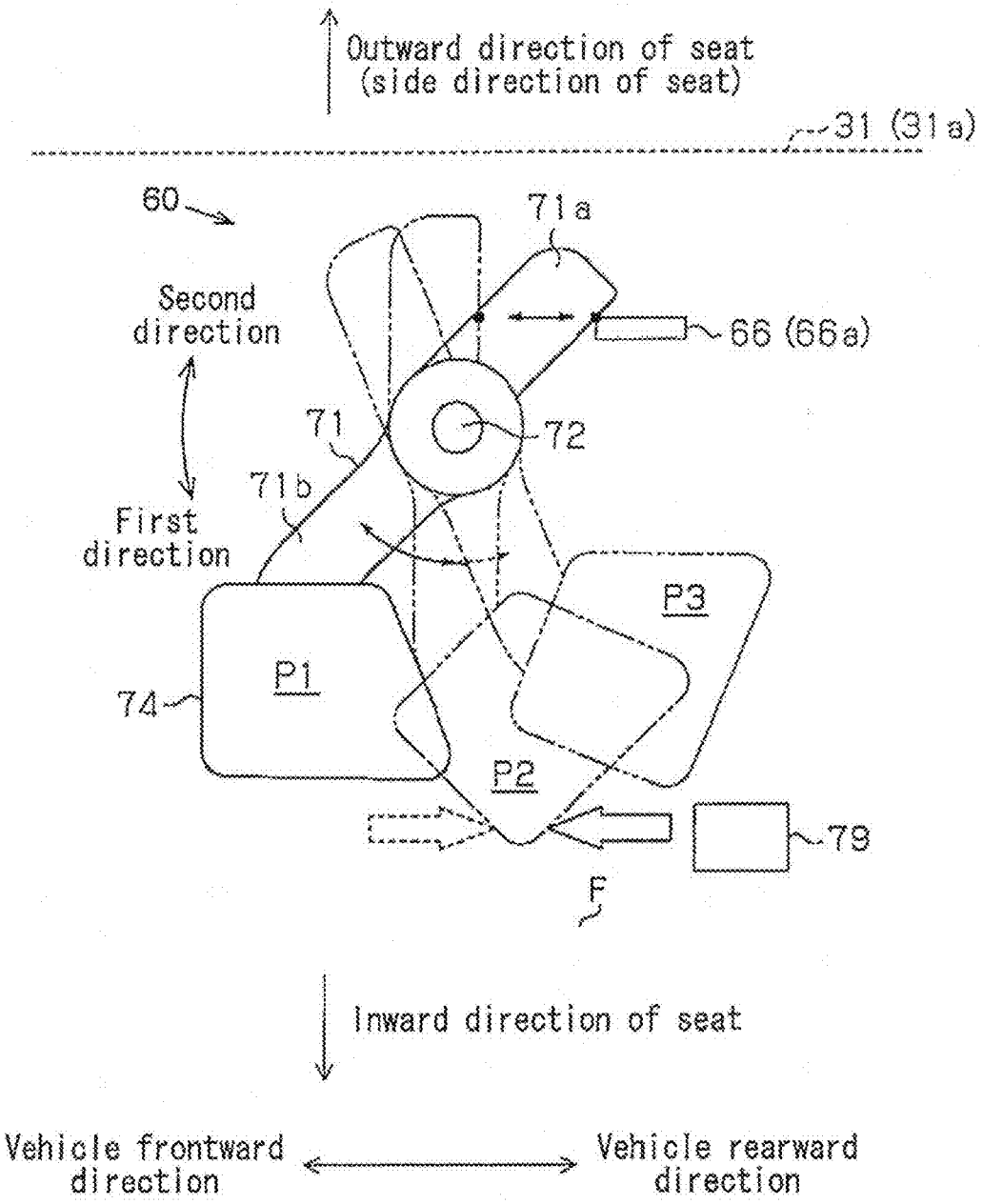

101
105
105b
N0
105a
152
120 (120b)
147
N1
N2
170
130
165
(165a)
150 (151)
131
113
103
102

FIG. 29


Outward direction of seat
(side direction of seat)
31 (31a)
60
71a
Second direction
66 (66a)
71
72
71b
First direction
P3
P1
74
P2
79
F
Inward direction of seat
Vehicle frontward direction
Vehicle rearward direction

# SEAT SLIDE APPARATUS FOR VEHICLE

## CROSS REFERENCE TO RELATED APPLICATIONS

This application is based on and claims priority under 35 U.S.C. §119 to Japanese Patent Application 2012-158776, filed on Jul. 17, 2012, the entire content of which is incorporated herein by reference.

## TECHNICAL FIELD

This disclosure generally relates to a seat slide apparatus for a vehicle.

## BACKGROUND DISCUSSION

In general, a seat slide apparatus for a vehicle includes a lower rail to be retained to a vehicle floor, an upper rail retaining a seat, the upper rail provided movably relative to the lower rail, and a lock mechanism for restraining movement of the upper rail relative to the lower rail. In the seat slide apparatus for a vehicle, a seat position in a vehicle frontward-rearward direction may be adjusted by releasing the lock mechanism from a restrained state to an unlocked state where the upper rail is allowed to move relative to the lower rail.

Furthermore, a known seat slide apparatus includes a function generally known as a walk-in function. The walk-in function brings a lock mechanism of the known seat slide apparatus to an unlocked state in accordance with an operation to knock down a seat back in a frontward direction and retains the lock mechanism in the unlocked state.

For example, a known seat slide apparatus disclosed in JP2004-122798A, hereinafter referred to as Reference 1, includes an unlock lever and an unlocked state retaining lever. The unlock lever rotationally moves in conjunction with an operation to knock down a seat back in a frontward direction to unlock a lock mechanism. The unlocked state retaining lever restrains the unlock lever from making rotational movement by engaging with the unlock lever. The unlock lever is restrained from making rotational movement at a position at which the unlock lever unlocks the lock mechanism. Accordingly, the lock mechanism is retained in an unlocked state in which the lock mechanism is unlocked. Furthermore, in the known seat slide apparatus according to Reference 1, a sensor bracket is arranged on a lower rail. In a case in which a walk-in function is operated, the sensor bracket and an end portion of an unlocked state release lever, which is integrally formed with the unlocked state retaining lever, make contact in accordance with an upper rail moving relative to the lower rail. As a result of the sensor bracket and the end portion of the unlocked state release lever making contact with each other, the unlocked state retaining lever makes rotational movement that disengages the unlocked state retaining lever and the unlock lever so that the lock mechanism is released from the state where the lock mechanism is maintained in the unlocked state.

In other words, the configuration of the known seat slide apparatus according to Reference 1 retains the lock mechanism in the unlocked state unless the upper rail moves to a position at which the unlocked state release lever makes contact with the sensor bracket. As a result, in order to adjust a seat to a desired position during sliding movement, the seat is required to move to a position where the seat is released from the state in which the seat is retained in the unlocked state first, then the seat is required to make the lock mechanism unlocked again to adjust the seat to the desired position, which is considered as a drawback.



A need thus exists for a seat slide apparatus for a vehicle, which is not susceptible to the drawback mentioned above.

## SUMMARY

A seat slide apparatus for a vehicle includes a lower rail configured to be retained on a floor portion of the vehicle, an upper rail configured to retain a seat, the upper rail configured to move relative to the lower rail, a lock mechanism configured to restrain movement of the upper rail relative to the lower rail, a first unlock mechanism including an unlock lever making rotational movement in response to an operational input at an operation lever, the first unlock mechanism operating the lock mechanism to unlock by the rotational movement of the unlock lever, a second unlock mechanism making the unlock lever rotationally move in a direction that unlocks the lock mechanism by pushing the unlock lever in accordance with a predetermined seat operation, an unlocked state retaining lever configured to retain the lock mechanism in an unlocked state cooperating with the second unlock mechanism by operating in conjunction with the second unlock mechanism to move to a position where the lock mechanism is retained in the unlocked state, a first unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from being retained in the unlocked state by making contact with an operation body in accordance with movement of the upper rail relative to the lower rail, and a second unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from being retained in the unlocked state by pushing the unlocked state retaining lever in accordance with the operational input.

## BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and additional features and characteristics of this disclosure will become more apparent from the following detailed description considered with the reference to the accompanying drawings, wherein:

FIG. **1** is a perspective view drawing illustrating a vehicle seat of a seat slide apparatus for a vehicle according to a first embodiment;

FIG. **2** is a side view drawing illustrating the vehicle seat of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **3** is a perspective view drawing illustrating a seat slide device and a seat reclining device of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **4** is a perspective view drawing illustrating a lock mechanism of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **5** is a cross-sectional view drawing taken along V-V in FIG. **4** illustrating a general configuration of the seat slide device of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **6** is a cross-sectional view drawing taken along VI-VI in FIG. **4** illustrating a general configuration of the lock mechanism of the seat slide apparatus for a vehicle according to the first embodiment in a state in which the lock mechanism is locked;

FIG. **7** is a cross-sectional view drawing taken along VII-VII in FIG. **4** illustrating a general configuration of the lock mechanism of the seat slide apparatus for a vehicle according to the first embodiment in a state in which the lock mechanism is operated to unlock;

FIG. **8** is a perspective view drawing illustrating an unlocked state retaining mechanism of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **9** is a side view drawing illustrating the unlocked state retaining mechanism of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **10**A is a drawing illustrating an operation of an unlocked state retaining lever of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **10**B is another drawing illustrating an operation of the unlocked state retaining lever of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **11** is a perspective view drawing illustrating a side surface of a seat of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **12** is a drawing illustrating an operation of an unlocked state release lever of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **13** is a perspective drawing illustrating a side surface of a seat adjacent to the seat of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **14** is a drawing illustrating an operation of a second unlocked state release lever of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **15**A is a drawing illustrating an operation of the unlocked state retaining mechanism of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **15**B is another drawing illustrating an operation of the unlocked state retaining mechanism of the seat slide apparatus for a vehicle according to the first embodiment;

FIG. **16** is a perspective view drawing illustrating a seat slide device of the seat slide apparatus for a vehicle according to a second embodiment;

FIG. **17** is a side view drawing illustrating the seat slide device of the seat slide apparatus for a vehicle according to the second embodiment viewing an inner side surface of the seat slide device;

FIG. **18** is a side view drawing illustrating the seat slide device of the seat slide apparatus for a vehicle according to the second embodiment viewing an outer side surface of the seat slide device;

FIG. **19** is a cross-sectional view drawing taken along XIX-XIX in FIG. **18** illustrating a general configuration of a lock mechanism of the seat slide apparatus for a vehicle according to the second embodiment;

FIG. **20** is a drawing illustrating an operation of an unlocked state retaining mechanism of the seat slide apparatus for a vehicle according to the second embodiment;

FIG. **21** is another drawing illustrating an operation of the unlocked state retaining mechanism of the seat slide apparatus for a vehicle according to the second embodiment in a state in which the unlocked state retaining mechanism is retaining the lock mechanism in an unlocked state;

FIG. **22** is a perspective view drawing illustrating an unlocked state retaining lever of the seat slide apparatus for a vehicle according to the second embodiment;

FIG. **23** is a drawing illustrating a positional relationship between a flange of the unlocked state retaining lever of the seat slide apparatus for a vehicle according to the second embodiment and a push portion of an unlock lever of the second embodiment in a state in which the lock mechanism is locked;

FIG. **24** is a cross sectional drawing taken along XXIV-XXIV in FIGS. **18** and **23**, which is a position close to the flange of the unlocked state retaining lever of the seat slide apparatus for a vehicle according to the second embodiment;

FIG. **25** is a drawing illustrating a positional relationship between the flange of the unlocked state retaining lever of the seat slide apparatus for a vehicle according to the second embodiment and the push portion of the unlock lever of the second embodiment in a state in which the lock mechanism is retained in the unlocked state;

FIG. **26** is a cross sectional drawing taken along XXVI-XXVI in FIG. **25**, which is a position close to the flange of the unlocked state retaining lever of the seat slide apparatus for a vehicle according to the second embodiment;

FIG. **27** is a drawing illustrating a positional relationship between the flange of the unlocked state retaining lever of the seat slide apparatus for a vehicle according to the second embodiment and the push portion of the unlock lever of the second embodiment in a state in which the lock mechanism is provided with a full stroke at the unlock lever;

FIG. **28** is a cross sectional drawing taken along XXVIII-XXVIII in FIG. **27**, which is a position close to the flange of the unlocked state retaining lever of the seat slide apparatus for a vehicle according to the second embodiment; and

FIG. **29** is a drawing illustrating a general configuration of an unlocked state retaining mechanism of the seat slide apparatus according to an alternative embodiment.

## DETAILED DESCRIPTION

A seat slide apparatus for a vehicle according to a first embodiment will be described referring to drawings. As FIG. **1** illustrates, a vehicle seat **1**, which serves as a seat, includes a seat cushion **2** and a seat back **3**. The seat back **3** is arranged such that the seat back **3** freely makes tilting movement relative to a rearward end portion of the seat cushion **2**. The vehicle seat **1** is arranged such that the vehicle seat **1** may be divided into a seat **11** and a seat **12**, which are a pair of seats separated into a rightward seat and a leftward seat. The vehicle seat **1** is provided as a rear seat, which more specifically is a second row seat. Each of the seat **11** and the seat **12** may adjust position in a vehicle frontward-rearward direction independently. Furthermore, each of the seat **11** and the seat **12** may adjust tilting angle of the seat back **3** independently.

More specifically, lower rails **5** are arranged on a floor portion F of the vehicle at positions corresponding to each of the seat **11** and the seat **12**. At each position two lower rails **5** are provided as a set and are arranged parallel to each other. In the seat slide apparatus for a vehicle according to the first embodiment, each of the seat **11** and the seat **12** is configured to adjust position in the vehicle frontward-rearward direction by making a seat slide device **20** that is formed at each of the lower rails **5** provided for each of the seat **11** and the seat **12** to function.

Note that, basic configurations of the seat slide device **20** for the seat **11** and that for the seat **12** are similar and basic configurations of seat reclining devices **35** for the seat **11** and those for the seat **12**, which will be described later, are similar. Accordingly, for convenience, common parts are described by describing the parts in the seat **11** and descriptions of the parts in the seat **12** will be omitted.

As FIGS. **2** to **4** illustrate, the seat slide device **20** includes an upper rail **21** corresponding to each of the lower rails **5**. Each of the upper rails **21** is provided movably relative to the lower rail **5**. The seat **11** is retained on the upper rails **21**. Accordingly, the seat **11** may move on the lower rails **5** together with the upper rails **21**.

More specifically, as FIG. **5** illustrates, the lower rail **5** includes a bottom wall **5***c* extending in the vehicle frontward-rearward direction. The vehicle frontward-rearward direction is a direction that is perpendicular to a surface where FIG. **5** is

drawn. At each end of the bottom wall **5***c* in a width direction of the bottom wall **5***c*, which is a leftward-rightward direction in FIG. **5**, an outer wall **5***d* erects. An upper end of each of the outer walls **5***d* is folded inwardly in the width direction so that a top wall **5***e* in a flange form is formed. An end of each of the top walls **5***e* is folded downwardly to form an inner wall **5***f*. The inner walls **5***f* face each other in the width direction with a predetermined distance therebetween.

Each of the upper rails **21** includes a body portion **21***a* and a pair of protruding portions **21***b*. The body portion **21***a* is formed in a U-shape with a closed end protruding in an upward direction and arranged between the inner walls **5***f* of the lower rail **5**. Each of bottom ends of the body portion **21***a* is folded outwardly in the width direction to form the protruding portion **21***b* formed in a flange form. Furthermore, the upper rail **21** includes hook portions **21***c*. Each end portion of the protruding portions **21***b* is folded upwardly to form the hook portion **21***c*. Each of the hook portions **21***c* is arranged in a space surrounded by the outer wall **5***d* of the lower rail **5**, the top wall **5***e* of the lower rail **5**, and the inner wall **5***f* of the lower rail **5**. Each of the hook portions **210** is provided with a multiple number of wheels **22**. In the seat slide apparatus for a vehicle according to the first embodiment, each lower rail **5** is provided with two wheels **22**. The wheels **22** roll on path portions **5***g* formed on the bottom wall **5***c* of the lower rail **5**. The wheels **22** roll in a state in which the wheels **22** are in contact with the path portions **5***g*.

The upper rail **21** of the seat slide apparatus for a vehicle according to the first embodiment is configured such that the upper rail **21** may move in a direction that conforms to an elongating direction of the lower rail **5** by rolling movement of each of the wheels **22**. Accordingly, the upper rail **21** runs on the path portions **5***g*. By arranging each of the protruding portions **21***b* and each of the hook portions **21***c* in a space surrounded by the outer wall **5***d* of the lower rail **5**, the top wall **5***e* of the lower rail **5**, and the inner wall **5***f* of the lower rail **5**, the upper rail **21** is restrained from movement in the upward direction relative to the lower rail **5** and restrained from movement in the width direction relative to the lower rail **5**. Accordingly, in the first embodiment, a positional relationship between the upper rail **21** and the lower rail **5** is stably retained.

As FIGS. **2** and **3** illustrate, a side frame **23** and a side frame **24** separately erects on each of the upper rails **21**. Each of the side frame **23** and the side frame **24** is formed in a plate form. As FIG. **2** illustrates, a connecting portion **25** is arranged to extend upwardly from a rear end portion of the side frame **23**, which is one of the side frames **23**, **24**. The rear end portion of the side frame **23** refers to an end portion of the side frame **23** in a leftward direction in FIG. **2**. As FIG. **3** illustrates, two pipes, which are a pipe **26** and a pipe **27**, are arranged to bridge between the side frame **23** and the side frame **24**. Furthermore, on a side portion of the side frame **24**, which is the other one of the side frames **23**, **24**, a sub frame **28** is arranged at a position substantially parallel to the side frame **24** in a state in which the sub frame **28** retains an end portion of the pipe **26** and an end portion of the pipe **27**. Similarly to at the side frame **23**, a connecting portion **25** is arranged at a rear end portion of the sub frame **28**.

As FIG. **1** illustrates, side shields **31**, **32** are arranged to cover the side frame **23**, the side frame **24**, and the sub frame **28** from an outward direction. Similarly, a center shield **33** is attached to the pipes **26**, **27** to cover the pipes **26**, **27** arranged to bridge between the side frame **24** and the sub frame **28** from outward. Furthermore, retaining a cushion member above the center shield **33** forms the seat cushion **2** of the seat slide apparatus for a vehicle according to the first embodiment.

Furthermore, as FIGS. **2** and **3** illustrate, a seat reclining device **35** is arranged at an end portion of the side frame **23** and another seat reclining device **35** is arranged at an end portion of the sub frame **28**. More specifically, each of the seat reclining devices **35** is arranged on the connecting portion **25** at the side frame **23** and the connecting portion **25** at the sub frame **28** such that the seat reclining devices **35** rotate with a bar **36** that is arranged to bridge between the seat reclining devices **35** as the center of rotational movement. Furthermore, the seat back **3** connects to the seat cushion **2** via the seat reclining devices **35**.

Each of the seat reclining devices **35** of the seat slide apparatus for a vehicle according to the first embodiment is provided with a known configuration for restraining and allowing rotational movement of the seat back **3** relative to the seat cushion **2**. More specifically, as FIGS. **1** and **3** illustrate, the sub frame **28** is provided with an operation lever **37** and a foot-operated lever **38**. The operation lever **37** protrudes in a side direction of the side shield **32** that covers the sub frame **28** from the outward direction. The operation lever **37** is manually operated. The foot-operated lever **38** protrudes in a rearward direction of the seat cushion **2**. Furthermore, as FIG. **3** illustrates, the sub frame **28** is provided with a spiral spring **39**. In accordance with an elastic force of the spiral spring **39**, the seat back **3** is biased in a direction that makes the seat back **3** tilt in a vehicle frontward direction, which is rightward in FIG. **2**. In other words, in accordance with the elastic force of the spiral spring **39**, the seat back **3** is biased in a direction that knocks down the seat back **3** in a frontward direction. Accordingly, a tilt angle of the seat **11** may be adjusted with an operation of the operation lever **37** and the seat back **3** of the seat **11** may be knocked down in the vehicle frontward direction by operating the foot-operated lever **38**.

Furthermore, the seat slide device **20** includes a lock mechanism **40** that may restrain the aforementioned movement of the upper rail **21** relative to the lower rail **5**. More specifically, as FIGS. **2** and **4** illustrate, the upper rail **21** is provided with lock levers **41**. Each of the lock levers **41** includes a multiple number of locking protrusions **41***a*. Furthermore, the lower rail **5** is formed with a multiple number of locking through-holes **42** for receiving the locking protrusions **41***a* of the lock lever **41**. The locking through-holes **42** are formed in a direction that conforms to a longitudinal direction of the lower rail **5**. Accordingly, the lock mechanism **40** of the seat slide apparatus for a vehicle according to the first embodiment is configured to restrain movement of the upper rail **21** relative to the lower rail **5** by the locking protrusions **41***a* of the lock lever **41** engaging with the locking through-holes **42** of the lower rail **5**.

More specifically, as FIGS. **6** and **7** illustrate, the lock lever **41** includes a body portion **41** b having an external form in a curved plate form. Furthermore, the body portion **21** a of the upper rail **21** is formed with insertion through-holes **43** extending through the body portion **21***a* in the width direction through a plate member forming the body portion **21***a*. Note that the width direction refers to a leftward-rightward direction in FIGS. **6** and **7**. Furthermore, the lock lever **41** links to the upper rail **21** in a state in which the body portion **41***b* is inserted through the insertion through-holes **43**.

More specifically, the lock lever **41** includes a rotation shaft that extends in a direction that conforms to an elongating direction of the upper rail **21**, which refers to a direction perpendicular to the surface where FIGS. **6** and **7** are drawn. The lock lever **41** is configured to rotationally move at the rotation shaft. Furthermore, on the body portion **21***a* of the upper rail **21** at a position in a downward direction relative to the insertion through-holes **43** and on the hook portions **21***c*,

a multiple number of insertion through-holes **44** are formed such that the insertion through-holes **44** may receive the locking protrusions **41***a* of the lock lever **41**. Note that, the position in the downward direction relative to the insertion through-holes **43** refers to a position in a downward direction in FIGS. **6** and **7**. Furthermore, the upper rail **21** is provided with spring members **45** so as to rotationally bias the lock levers **41** in a direction that makes the locking protrusions **41***a* inserted into the insertion through-holes **44**, which is a clockwise direction in FIGS. **6** and **7**.

Accordingly, at a normal time, the lock mechanism **40** of the seat slide apparatus for a vehicle according to the first embodiment is in a locked state, as FIG. **6** illustrates, which is a state in which the lock lever **41** makes rotational movement in accordance with an elastic force of the spring member **45** and the locking protrusions **41** a inserted into the insertion through-holes **44** engage with the locking through-holes **42** of the lower rail **5** via the insertion through-holes **44**.

Furthermore, the lock lever **41** of the seat slide apparatus according to the first embodiment includes a lever portion **41***c*. The lever portion **41***c* is arranged at an end portion of the lock lever **41** that is opposite side to where the locking protrusions **41***a* are arranged. In a state in which the lever portion **41***c* is pushed downwardly, the lock lever **41** rotationally moves in a direction that makes the lock mechanism **40** unlock, which is a counterclockwise direction in FIGS. **6** and **7**, against the elastic force of the spring member **45**. As a result of pushing the lever portion **41***c* downwardly and the lock lever **41** moving rotationally, the lock mechanism **40** of the first embodiment is operated into an unlocked state in which the locking protrusions **41***a* are pulled out from the insertion through-holes **44** as FIG. **7** illustrates, which is a state in which the lock mechanism **40** is unlocked by the locking through-holes **42** of the lower rail **5** and the locking protrusions **41***a* being disengaged.

More specifically, as FIG. **4** illustrates, each of the upper rails **21** is provided with two lock levers, which are a lock lever **41**A and a lock lever **41**B. The lock lever **41**A and the lock lever **41**B are arranged in a direction that conforms to a longitudinal direction of the upper rail **21**. Furthermore, as FIGS. **3** and **4** illustrate, at positions above the lock levers **41**A, **41**B, a pair of rotation shafts **46**, **47** are arranged such that each of the rotation shaft **46** and the rotation shaft **47** bridges between the side frame **23** and the sub frame **28**. Furthermore, similarly to the aforementioned operation lever **37** for a seat reclining operation, the sub frame **28** is provided with an operation lever **48** that protrudes in the side direction of the side shield **32**. The operation lever **48** is manually operated. Furthermore, the sub frame **28** is provided with a link mechanism **49** that converts an operational input at the operation lever **48** into rotational movement of the rotation shaft **46** and rotational movement of the rotation shaft **47**. Each of the rotation shaft **46** and the rotation shaft **47** is provided with an unlock lever **50**. Each of the unlock levers **50** makes rotational movement integrally with each of the rotation shaft **46** and the rotation shaft **47** and downwardly pushes the lever portion **41***c* of each of the lock lever **41**A and the lock lever **41**B. Note that, the rotation shaft **46**, the rotation shaft **47**, the link mechanism **49**, and the unlock lever **50** serves as a first unlock mechanism.

More specifically, by an operation of the operation lever **48** by an operator, which is an operation to pull the operation lever **48** upwardly in a case with the seat slide apparatus for a vehicle according to the first embodiment, each of the rotation shaft **46** and the rotation shaft **47** makes rotational movement. Accordingly, the unlock lever **50** arranged on the rotation shaft **46** and the unlock lever **50** arranged on the rotation shaft **47** push the lock lever **41**A and the lock lever **41**B, respectively. As a result, the lock mechanism **40** is operated into the unlocked state in which the lock mechanism **40** is unlocked.

Note that, in the seat slide apparatus for a vehicle according to the first embodiment, each of the unlock levers **50** is biased by an elastic force of a coil spring **51**. Each of the unlock levers **50** is biased in a direction opposite to a direction in which each of the unlock levers **50** pushes down the lock lever **41**A and the lock lever **41**B. Similarly, an elastic force of a coil spring **52** biases the operation lever **48**. The operation lever **48** is biased in a direction in which the operation lever **48** moves to a position before the operation of the operation lever **48**. Accordingly, in the first embodiment, the lock mechanism **40** is returned to the locked state in a state where the operator ceases to provide the operational input at the operation lever **48**.

A walk-in function of the seat slide apparatus for a vehicle according to the first embodiment will be described next.

As FIG. **2** illustrates, the side frame **23** of the seat **11** is provided with an unlocked state retaining mechanism **60**. The unlocked state retaining mechanism **60** is configured to operate in conjunction with an operation to knock down the seat back **3** in the frontward direction to operate the lock mechanism **40** to unlock and retains the lock mechanism **40** in the unlocked state.

More specifically, as FIGS. **8** and **9** illustrate, the unlocked state retaining mechanism **60** of the seat slide apparatus for a vehicle according to the first embodiment includes a second unlock lever **61** having a common center of rotational movement L with the unlock lever **50** and arranged at a position parallel to the unlock lever **50**.

In the seat slide apparatus for a vehicle according to the first embodiment, the second unlock lever **61** is arranged at a position parallel to an unlock lever **50**A and shares a common axis with an unlock lever **50**A on the upper rail **21** that is provided with the side frame **23**. Note that, the unlock lever **50**A is the unlock lever **50** that corresponds to the lock lever **41**A. The lock lever **41**A is the lock lever **41** arranged at a position in the vehicle frontward direction. Furthermore, the second unlock lever **61** includes a push lever portion **61***a* and a connecting lever portion **61***b*. The push lever portion **61***a* extends in a longitudinal direction of the unlock lever **50**A with the center of rotational movement L of the second unlock lever **61** as a proximal end. Note that, the longitudinal direction of the unlock lever **50**A refers to a rightward-leftward direction in FIG. **9**. The connecting lever portion **61***b* extends in an upward direction with the center of rotational movement L as a proximal end. Note that the upward direction refers to the upward direction in FIG. **9**. A distal end of the push lever portion **61***a* is folded toward the unlock lever **50**A so that a push flange **62** is formed. The push flange **62** is formed such that the push flange **62** may contact an upper end portion **50***a* of the unlock lever **50**A.

Furthermore, as FIG. **2** illustrates, the seat reclining device **35** provided on the connecting portion **25** of the side frame **23** is formed with a pulling portion **64**. The pulling portion **64** rotationally moves in accordance with knock down movement of the seat back **3** in the frontward direction and pulls up a wire **63** that is connected to an end of the pulling portion **64**. As FIG. **9** illustrates, a connecting portion **65** is provided at a distal end of the connecting lever portion **61***b*, which is a portion of the second unlock lever **61**. The other end of the wire **63** connects to the connecting portion **65**. Note that, the second unlock lever **61**, the wire **63**, and the pulling portion **64** serve as a second unlock mechanism.

More specifically, in accordance with a pull force of the wire **63**, which is a force generated by the knock down move-

ment of the seat back **3** in the frontward direction, the second unlock lever **61** rotationally moves in a direction in which the connecting lever portion **61***b* is pulled in a rearward direction, which is rotational movement in a counterclockwise direction in FIG. **9**. Note that, the rearward direction refers to leftward in FIG. **9**. Furthermore, the rotational movement makes the push flange **62** arranged on the second unlock lever **61** to push the upper end portion **50***a* of the unlock lever **50**A. In accordance with a push force of the push flange **62**, the unlock lever **50**A and the second unlock lever **61** make rotational movements together.

As FIG. **4** illustrates, in the seat slide apparatus for a vehicle according to the first embodiment, the rotational movement of the unlock lever **50**A is transmitted to the other unlock lever **50** via the rotation shaft **46** at which the unlock lever **50**A is retained, the link mechanism **49**, and the rotation shaft **47**. In the unlocked state retaining mechanism **60** of the first embodiment, the lock mechanism **40** provided with the lock levers **41** is operated to unlock by each of the unlock levers **50** pushing down the corresponding lock lever **41**, which is either the lock lever **41**A or the lock lever **41**B.

Furthermore, as FIGS. **2**, **8** and **9** illustrate, the unlocked state retaining mechanism **60** of the seat slide apparatus for a vehicle according to the first embodiment includes an unlocked state retaining lever **66**. The unlocked state retaining lever **66** is configured to rotationally move in a state in which the unlocked state retaining lever **66** is in contact with an outer peripheral portion of the second unlock lever **61**. After the second unlock lever **61** rotationally moves and unlocks the lock mechanism **40**, the unlocked state retaining lever **66** and the second unlock lever **61** cooperate to retain the lock mechanism **40** in the unlocked state.

More specifically, as FIGS. **8** and **9** illustrate, the unlocked state retaining lever **66** includes a rotation shaft **67**. The rotation shaft **67** is arranged at a position in an upward direction relative to the second unlock lever **61**. Note that, the upward direction refers to an upward direction in FIGS. **8** and **9**. The rotation shaft **67** is arranged such that the rotation shaft **67** is substantially parallel to the center of rotational movement L of the second unlock lever **61**, which is the rotation shaft **46**. An end portion **66***a* of the unlocked state retaining lever **66** is configured to make contact with the outer peripheral portion of the second unlock lever **61** biased by a helical torsion spring **68** fit to the rotation shaft **67**. Note that, the helical torsion spring **68** biases the unlocked state retaining lever **66** in the counterclockwise direction in FIG. **9**.

As FIGS. **10**A and **10**B illustrate, the connecting lever portion **61***b* of the second unlock lever **61** is formed with a hook-form portion **69**, which is a portion bent in a form similar to a hook. The end portion **66***a* of the unlocked state retaining lever **66** is configured such that the end portion **66***a* makes contact with the second unlock lever **61** at a portion near the hook-form portion **69**.

More specifically, as FIG. **10**A illustrates, in a state before the seat back **3** is operated to knock down in the frontward direction and the second unlock lever **61** makes rotational movement, the end portion **66***a* of the unlocked state retaining lever **66** is in contact with the second unlock lever **61** at a position closer to the distal end of the connecting lever portion **61***b* relative to the hook-form portion **69**, which is a position closer to the connecting portion **65** relative to the hook-form portion **69**. Furthermore, as FIG. **10**B illustrates, in a state in which the second unlock lever **61** is rotated to a position that makes the lock mechanism **40** unlock, the end portion **66***a* of the unlocked state retaining lever **66** is configured to be in contact with the second unlock lever **61** at a position closer to the proximal end of the connecting lever portion **61***b* relative to the hook-form portion **69**, which is a position closer to the center of rotational movement L relative to the hook-form portion **69**.

More specifically, in a state in which the unlocked state retaining lever **66** rotationally moves in conjunction with movement of the second unlock lever **61**, a contact point of the unlocked state retaining lever **66** on the second unlock lever **61** seemingly moves on an outer peripheral portion of the connecting lever portion **61***b* from a position in the direction of the distal end to a position in the direction of the proximal end.

In the seat slide apparatus for a vehicle according to the first embodiment, the hook-form portion **69** and the end portion **66***a* of the unlocked state retaining lever **66** are configured such that the end portion **66***a* engages with the hook-form portion **69** in a state in which a contact point between the unlocked state retaining lever **66** and the second unlock lever **61** moves closer to the proximal end of the connecting lever portion **61***b* relative to the hook-form portion **69**. Accordingly, rotational movement of the second unlock lever **61** is restrained and the lock mechanism **40** may be retained in the unlocked state in which the lock mechanism **40** is unlocked.

Furthermore, the unlocked state retaining mechanism **60** includes an unlocked state release lever **71**, which serves as a first unlocked state release mechanism. The unlocked state release lever **71** is configured to release the lock mechanism **40** from the state in which the lock mechanism **40** is retained in the unlocked state, which is retained by an operation of the unlocked state retaining lever **66**, in accordance with movement of the upper rail **21** relative to the lower rail **5**.

As FIGS. **8** and **9** illustrate, the unlocked state release fever **71** includes a rotation shaft **72** extending in an upward-downward direction arranged skew to the rotation shaft **67** of the unlocked state retaining lever **66**. Note that, the upward-downward direction refers to an upward-downward direction in FIGS. **8** and **9**. Furthermore, the unlocked state release lever **71** includes an action bar **71***a* and an operation bar **71***b* extending straight in opposite directions relative to the rotation shaft **72**, which is a proximal end for each of the action bar **71***a* and the operation bar **71***b*.

More specifically, each of the action bar **71***a* and the operation bar **71***b* is formed in a form similar to an elongated plate. A helical torsion spring **73** fits to the rotation shaft **72**. The helical torsion spring **73** biases the unlocked state release lever **71** such that the action bar **71***a* of the unlocked state release lever **71** makes contact with the end portion **66***a* of the unlocked state retaining lever **66** from the vehicle frontward direction, which is from right in FIG. **9**.

Furthermore, at a distal end of the operation bar **71***b*, a rotation operation portion **74**, which serves as a first end, is attached. The rotation operation portion **74** is formed in a cube form and is formed by resin or a similar material. The unlocked state release lever **71** of the seat slide apparatus for a vehicle according to the first embodiment is configured to rotationally move in a direction in accordance with a direction in which an operation body makes contact with the rotation operation portion **74**. Note that, the unlocked state release lever **71**, the rotation shaft **72**, the helical torsion spring **73**, and the rotation operation portion **74** serve as a first unlocked state release mechanism.

As FIG. **11** illustrates, a housing cover **75** is provided on the side shield **31** that surrounds the side frame **23** and the unlocked state retaining mechanism **60** from the outward direction. The housing cover **75** is configured to contain the rotation operation portion **74** that is arranged at the distal end of the operation bar **71***b*. The housing cover **75** is formed such that the housing cover **75** does not restrain rotational move-

ment of the rotation operation portion **74**. Furthermore, the housing cover **75** includes an opening portion **75***a* on a side surface **31***a* of the side shield **31**. In the seat slide apparatus for a vehicle according to the first embodiment, the rotation operation portion **74** that is arranged at the distal end of the operation bar **71***b* is configured to protrude from the opening portion **75***a* of the housing cover **75** to protrude in the side direction of the side shield **31** in accordance with rotational movement of the unlocked state release lever **71**.

More specifically, as FIG. **12** illustrates, a contact point between the unlocked state retaining lever **66** and the action bar **71***a* of the unlocked state release lever **71** moves in the vehicle frontward-rearward direction, which is a leftward-rightward direction in FIG. **12**, in accordance with rotational movement of the unlocked state retaining lever **66**.

More specifically, the end portion **66***a* of the unlocked state retaining lever **66** that is in contact with the second unlock lever **61** moves toward the vehicle frontward direction, which is leftward in FIG. **12**, in conjunction with rotational movement of the second unlock lever **61** as illustrated in FIGS. **10**A, **10**B. Furthermore, the unlocked state release lever **71** is biased by the helical torsion spring **73** so that the action bar **71***a* of the unlocked state release lever **71** makes contact with the end portion **66***a* of the unlocked state retaining lever **66** from the vehicle frontward direction.

As a result, by the end portion **66***a* of the unlocked state retaining lever **66** moving in the vehicle frontward direction, the action bar **71***a*, which is the contact point between the unlocked state retaining lever **66** and the unlocked state release lever **71**, makes rotational movement in a direction in which the action bar **71***a* of the unlocked state release lever **71** moves in the vehicle frontward direction, which is the clockwise direction in FIG. **12**.

More specifically, in the seat slide apparatus for a vehicle according to the first embodiment, the rotational direction the action bar **71***a* moves toward the vehicle frontward direction is referred to as a first direction of the rotational movement of the unlocked state release lever **71**. The rotational direction in the opposite direction relative to the first direction is referred to as a second direction of the rotational movement of the unlocked state release lever **71**.

The unlocked state release lever **71** of the seat slide apparatus for a vehicle according to the first embodiment is configured such that an entire portion of the rotation operation portion **74**, which is arranged on the operation bar **71***b*, is contained in the housing cover **75** in a state in which the rotation operation portion **74** is at a rotational position P**1**. The rotational position P**1** corresponds to a state before the unlocked state release lever **71** rotationally moves in the first direction, which is a state before the unlocked state retaining lever **66** moves in conjunction with the second unlock lever **61** to a position where the lock mechanism **40** is retained in the unlocked state. In a state in which the unlocked state release lever **71** rotationally moves in conjunction with the movement of the unlocked state retaining lever **66** that is in contact with the unlocked state release lever **71**, the rotation operation portion **74** protrudes from the opening portion **75***a* of the housing cover **75** to protrude in the side direction of the side shield **31**.

More specifically, the unlocked state release lever **71** of the seat slide apparatus for a vehicle according to the first embodiment is configured such that an operation body may not contact with the rotation operation portion **74** of the unlocked state release lever **71** in a state before which the lock mechanism **40** is operated into the unlocked state by operating a walk-in function that is operated by an operation to knock down the seat back **3** in the frontward direction.

The unlocked state release lever **71** rotationally moves in the first direction in conjunction with the unlocked state retaining lever **66** moving to the position where the lock mechanism **40** is retained in the unlocked state. As a result, the rotation operation portion **74** is exposed to a portion outside of the housing cover **75**. Accordingly, an operation body is allowed to make contact with the rotation operation portion **74** of the unlocked state release lever **71** of the seat slide apparatus for a vehicle according to the first embodiment. The operation body is allowed to make contact with the rotation operation portion **74** in the vehicle frontward-rearward direction, which is the direction that conforms to the direction of movement of the seat **11**, which in other words is the direction that conforms to the direction of the movement of the upper rail **21** relative to the lower rail **5**.

More specifically, with an operation to unlock the lock mechanism **40** in accordance with an operation of the walk-in function, the unlocked state release lever **71** rotationally moves in the first direction to a rotational position P**2** that corresponds to a state in which the unlocked state retaining lever **66** has moved to the position where the lock mechanism **40** is retained in the unlocked state.

At this time, in a case where an operation body makes contact with the rotation operation portion **74** protruding from the opening portion **75***a* of the housing cover **75** from the vehicle rearward direction, which is rightward in FIG. **12**, the unlocked state release lever **71** makes rotational movement in the second direction, which is the direction in which the action bar **71***a* moves in the vehicle rearward direction. Note that, the action bar **71***a* serves as the second end. Accordingly, the unlocked state retaining mechanism **60** of the seat slide apparatus for a vehicle according to the first embodiment releases the lock mechanism **40** from a state in which the lock mechanism **40** is retained in the unlocked state in accordance with the rotational movement of the unlocked state release lever **71** in the second direction.

Furthermore, by the unlocked state release lever **71** making the rotational movement in the second direction, the unlocked state retaining lever **66** is pushed in the vehicle rearward direction by the action bar **71***a* that is in contact with the unlocked state retaining lever **66**. In accordance with a force that pushes the unlocked state retaining lever **66**, the unlocked state retaining lever **66** makes rotational movement. Accordingly, an engagement between the end portion **66***a* of the unlocked state retaining lever **66** and the hook-form portion **69** of the second unlock lever **61** is disengaged so that the lock mechanism **40** returns to the state in which the lock mechanism **40** is locked.

Furthermore, in the seat slide apparatus for a vehicle according to the first embodiment, in a state in which an input by an outside force that is against the elastic force of the helical torsion spring **73** is provided on the rotation operation portion **74** of the unlocked state release lever **71**, the unlocked state release lever **71** is configured to rotationally move in the first direction to a position farther in the first direction relative to the rotational position P**2** corresponding to the state in which the unlocked state retaining lever **66** has moved to the position where the lock mechanism **40** is retained in the unlocked state. Note that, an operation body making contact is an example of the input by an outside force.

More specifically, the unlocked state release lever **71** rotationally moves in the first direction so that the rotation operation portion **74** arranged at the distal end of the operation bar **71***b* is entirely contained in the housing cover **75**. At this time, the action bar **71***a* of the unlocked state release lever **71** is separated from the unlocked state retaining lever **66**. Even in the state in which the action bar **71***a* is separated from the

unlocked state retaining lever **66**, the unlocked state retaining lever **66** remains in the state in which the end portion **66***a* of the unlocked state retaining lever **66** and the hook-form portion **69** of the second unlock lever **61** are engaged. In other words, the unlocked state retaining lever **66** is still at the position that may retain the lock mechanism **40** in the unlocked state, as FIG. **10**B illustrates. Accordingly, while retaining the lock mechanism **40** in the unlocked state, the unlocked state retaining mechanism **60** of the seat slide apparatus for a vehicle according to the first embodiment allows the unlocked state release lever **71** to rotationally move in the first direction to a rotational position P**3** at which an operation of the rotation operation portion **74** by a contact of the operation body is restrained.

As FIGS. **1** and **13** illustrate, in the seat slide apparatus for a vehicle according to the first embodiment, on a side shield **77** of the seat **12**, which is the seat adjacent to the seat **11**, an operation protrusion **78** protrudes in a direction toward the side shield **31** of the seat **11** from a side surface **77***a* of the side shield **77**.

More specifically, the operation protrusion **76** is arranged at a position that corresponds to the opening portion **75***a* of the housing cover **75** provided on the side surface **31***a* of the side shield **31**. To be more specific, the operation protrusion **78** is arranged at a position having same height in a seat height direction as the opening portion **75***a*. Note that, the seat height direction refers to an upward-downward direction in FIG. **2**. Furthermore, the operation protrusion **78** is arranged at a position that is displaced slightly in the vehicle frontward direction relative to the opening portion **75***a* of the seat **11** in a state in which the seat **11** and the seat **12** arranged side by side are at positions aligned in the vehicle frontward-rearward direction.

More specifically, the unlocked state retaining mechanism **60** of the seat slide apparatus for a vehicle according to the first embodiment is configured such that the operation protrusion **78**, which serves as an operation body, makes contact with the rotation operation portion **74** in accordance with displacement of the seat **11** in the vehicle frontward-rearward direction. Accordingly, the unlocked state release lever **71** rotationally moves in the second direction so that the lock mechanism **40** is released from the state in which the lock mechanism **40** is retained in the unlocked state.

Furthermore, as FIGS. **8** and **9** illustrate, on the rotation shaft **46** of the unlock lever **50**, a second unlocked state release lever **81** is arranged. The second unlocked state release lever **81** makes rotational movement integrally with the rotation shaft **46** in accordance with the operational input at the operation lever **48**. In the seat slide apparatus for a vehicle according to the first embodiment, the second unlocked state release lever **81**, which serves as a second unlocked state release mechanism, is configured to push the unlocked state retaining lever **66** to move the unlocked state retaining lever **66** to a position where the lock mechanism **40** is released from the state in which the lock mechanism **40** is retained in the unlocked state.

More specifically, the second unlocked state release lever **81** of the seat slide apparatus according to the first embodiment is formed in a form similar to an elongated plate. With a portion that is retained at the rotation shaft **46** as a proximal end, the second unlocked state release lever **81** extends in an upward direction toward a distal end **81***a*. Furthermore, the second unlocked state release lever **81** is retained at a position at which the second unlock lever **61** is sandwiched between the second unlocked state release lever **81** and the unlock lever **50** on an axis of the rotation shaft **46**. The second unlocked state release lever **81** is retained at a position that is outward relative to the unlock lever **50** in a width direction of the vehicle seat **1**, which is toward a viewer of FIG. **9** in a perpendicular direction relative to the surface where FIG. **9** is drawn. Accordingly, the second unlocked state release lever **81** is configured to make rotational movement integrally with the unlock lever **50** with the rotation shaft **46** as the center of the rotational movement.

Furthermore, a protruding portion to be pushed **82** is arranged at the end portion **66***a* of the unlocked state retaining lever **66**. The protruding portion to be pushed **82** is pushed by the distal end **81***a* of the second unlocked state release lever **81** by the rotational movement of the second unlocked state release lever **81** in accordance with the operational input at the operation lever **48**. Note that, the second unlocked state release lever **81** and the protruding portion to be pushed **82** serve as a second unlocked state release mechanism. More specifically, the protruding portion to be pushed **82** is formed in a form similar to a flat plate and is retained at a flat surface portion **66***b* of the unlocked state retaining lever **66**, which is the surface in the outward direction in the width direction of the vehicle seat **1**. Note that, the outward direction in the width direction of the vehicle seat **1** refers to the direction toward the viewer of FIG. **9** in the perpendicular direction relative to the surface where FIG. **9** is drawn. Furthermore, the protruding portion to be pushed **82** includes an end portion **82***a* protruding from the end portion **66***a* of the unlocked state retaining lever **66** in a direction that conforms to the direction in which the unlocked state retaining lever **66** is biased, which is the counterclockwise direction in FIG. **9**. In the seat slide apparatus for a vehicle according to the first embodiment, the end portion **82***a* mainly is the portion at which the distal end **81***a* of the second unlocked state release lever **81** pushes.

As FIG. **10**A illustrates, the second unlocked state release lever **81** is configured to remain at a position at which the second unlocked state release lever **81** does not interfere with the unlocked state retaining lever **66** even at a time of the operational input at the operation lever **48** in a state before the second unlock lever **61** rotationally moves in response to the operation to knock down the seat back **3** in the frontward direction, which is in a state where the second unlock lever **61** is at a position at which the second unlock lever **61** is not pushing the unlock lever **50**.

More specifically, as FIG. **14** illustrates, in the seat slide apparatus for a vehicle according to the first embodiment, the second unlocked state release lever **81** pushes the protruding portion to be pushed **82** on condition that the lock mechanism **40** is retained in the unlocked state by the unlocked state retaining lever **66** and, additionally, the rotation shaft **46** and the unlock lever **50** are further rotated by an operational input at the operation lever **48** into a full stroke state. Note that, the rotational movement for the full stroke state is in the counterclockwise direction in FIG. **14**. A two-dot chain line N**0** in FIG. **14** indicates a position of an end portion of the unlock lever **50** at a time at which the lock mechanism **40** is in the locked state, which is the state in which the lock mechanism **40** is locked, and the operation lever **48** is not operated. A two-dot chain line N**1** in FIG. **14** indicates the position of the end portion of the unlock lever **50** at a time at which the lock mechanism **40** is retained in the unlocked state and the operation lever **48** is not operated. Furthermore the two-dot chain line N**2** in FIG. **14** indicates the position of the end portion of the unlock lever **50** at a time at which the unlock lever **50** is operated into the full stroke state by the operational input at the operation lever **48**. In the first embodiment, by operating the unlock lever **50** into the full stroke state, the unlocked state retaining lever **66** makes rotational movement in a direction that disengages the unlocked state retaining lever **66** and the

second unlock lever **61**, which is the clockwise direction in FIG. **14**, so that the lock mechanism **40** may be released from the state in which the lock mechanism **40** is retained in the unlocked state.

Operations of the unlocked state retaining mechanism **60** of the seat slide apparatus for a vehicle according to the first embodiment provided with the aforementioned configuration will be described next. As FIG. **15**A illustrates, the seat **11**, which is retained in the state in which the lock mechanism **40** is unlocked by operating the walk-in function, is operated to move in the vehicle frontward direction, which is toward left in FIG. **15**A. Afterwards, in many cases, the seat **11** is returned to a position that arranges the seat **11** and the seat **12**, which is the seat adjacent to the seat **11**, to be positioned side by side. More specifically, the seat **11** is returned to the position at which the edges of the seat **11** and the seat **12** in the vehicle frontward-rearward direction are aligned at a broken line M in FIG. **15**A.

In the seat slide apparatus for a vehicle according to the first embodiment, a seat sliding operation at this time makes the rotation operation portion **74** that is protruding from a side of the seat **11** to contact with the operation protrusion **78** that is arranged on the seat **12**, which is the seat that is adjacent to the seat **11**. More specifically, at a time at which the seat **11** is displaced in the vehicle rearward direction, the rotation operation portion **74** of the seat **11** makes contact with the operation protrusion **78** that is arranged on the seat **12**. Relative to the rotation operation portion **74** of the seat **11** making contact with the operation protrusion **78**, the unlocked state release lever **71** is operated to rotationally move in the second direction, which is a rotational operation illustrated with a solid line arrow in FIG. **12**. Accordingly, the operation to move the unlocked state release lever **71** rotationally in the second direction releases the lock mechanism **40** from the state in which the lock mechanism **40** is retained in the unlocked state and the seat **11** is retained at a position at which the seat **11** and the seat **12** are aligned side by side.

Furthermore, as FIG. **15**B illustrates, at a time at which the walk-in function is operated, the seat **11** may be at a position in the vehicle rearward direction, which is rightward in FIG. **15**B. In such case the rotation operation portion **74** that is protruding from the side of the seat **11** makes contact with the operation protrusion **78** that is arranged on the seat **12**, which is the seat that is adjacent to the seat **11**, from the vehicle rearward direction by a seat sliding operation of the seat **11** in the vehicle frontward direction.

Accordingly, in the seat slide apparatus for a vehicle according to the first embodiment, the unlocked state release lever **71** makes further rotational movement in the first direction, which is a rotational operation illustrated with a broken line arrow in FIG. **12**. Note that, the rotational movement in the first direction is in the clockwise direction in FIG. **15**B. The unlocked state release lever **71** makes rotational movement to a position at which the unlocked state release lever **71** is restrained from a rotational operation in response to the rotation operation portion **74** making contact with the operation protrusion **78**, which is the rotational position P**3** illustrated in FIG. **12**. Without the rotation operation portion **74** interfering with the operation protrusion **78** that is on the seat **12**, the seat **11** may be smoothly displaced in the vehicle frontward direction.

Furthermore, in the seat slide apparatus for a vehicle according to the first embodiment, by an operation of the operation lever **48** by an operator, the second unlocked state release lever **81** that makes rotational movement integrally with the unlock lever **50** pushes the unlocked state retaining lever **66** even at a time after which the walk-in function is operated and the seat **11** has moved in the vehicle frontward direction and before which the seat **11** is moved in the rearward direction from the vehicle frontward direction to the position at which the seat **11** and the seat **12**, which is the seat adjacent to the seat **11**, are aligned side by side. Accordingly, the unlocked state retaining lever **66** rotationally moves in a direction that releases the lock mechanism **40** from the state in which the lock mechanism **40** is retained in the unlocked state so that the seat **11** may be retained at a selected position during a sliding movement.

The seat slide apparatus for a vehicle according to the first embodiment is advantageous in following aspects. First, the unlocked state retaining mechanism **60** includes the second unlock lever **61**. The second unlock lever **61** pushes the unlock lever **50** in response to an operation to knock down the seat back **3** in the frontward direction to operate the lock mechanism **40** make rotational movement in the direction that unlocks the lock mechanism **40**. Furthermore, the unlocked state retaining mechanism **60** includes the unlocked state retaining lever **66**. The unlocked state retaining lever **66** is configured to rotationally move in conjunction with movement of the second unlock lever **61** to the position at which the lock mechanism **40** is retained in the unlocked state and cooperates with the second unlock lever **61** to retain the lock mechanism **40** in the unlocked state. Furthermore, the unlocked state retaining mechanism **60** includes the unlocked state release lever **71**. The unlocked state release lever **71** makes rotational movement by the rotation operation portion **74** of the unlocked state release lever **71** coming into contact with the operation protrusion **78** in accordance with movement of the upper rail **21** relative to the lower rail **5**. Note that, the rotation operation portion **74** serves as the first end. Accordingly, the action bar **71***a* of the unlocked state release lever **71** pushes the unlocked state retaining lever **66** in the direction that releases the lock mechanism **40** from the state in which the lock mechanism **40** is retained in the unlocked state. Note that, the action bar **71***a* serves as the second end. Furthermore, the unlocked state retaining mechanism **60** includes the second unlocked state release lever **81**. The second unlocked state release lever **81** makes rotational movement integrally with the unlock lever **50** in response to the operational input at the operation lever **48** and pushes the unlocked state retaining lever **66** in the direction that releases the lock mechanism **40** from retained in the unlocked state.

Upon the above-mentioned configuration, the lock mechanism **40** may be released from the state in which the lock mechanism **40** is retained in the unlocked state at a selected position during sliding movement even at a time before which the unlocked state release lever **71** makes contact with the operation protrusion **78** in accordance with movement of the upper rail **21** relative to the lower rail **5** and the unlocked state release lever **71** pushes the unlocked state retaining lever **66** in the direction that releases the lock mechanism **40** from the state in which the lock mechanism **40** is retained in the unlocked state. As a result, a seat position may be adjusted with easier operation and with more convenience.

Second, the second unlocked state release lever **81** is arranged to remain at a position that does not interfere with the unlocked state retaining lever **66** or with the protruding portion to be pushed **82** even at a time of the operational input at the operation lever **48** in a state where the second unlock lever **61** is not pushing the unlock lever **50**.

Upon the above-mentioned configuration, at a time at which the lock mechanism **40** is unlocked by an operation at the operation lever **48** in a normal seat sliding operation, the unlocked state retaining lever **66** does not make rotational movement. As a result, a false operation may be prevented to

secure high reliability of the seat sliding operation. Furthermore, a noise that is generated by the second unlocked state release lever **81** making contact with the unlocked state retaining lever **66** may be prevented so that the seat slide apparatus may be operated with an operational noise kept at a low level.

The seat slide apparatus for a vehicle according to a second embodiment will be described next referring to drawings. As FIG. **16** illustrates, the seat slide device **101** of the second embodiment includes two lower rails **102** extending parallel to each other in the vehicle frontward-rearward direction and upper rails **103** arranged to move relative to the lower rails **102** in an elongating direction of the lower rails **102** on the lower rails **102**, similarly to the seat slide device **20** of the seat slide apparatus for a vehicle according to the first embodiment. A seat is retained on the upper rails **103** such that a position of the seat in the vehicle frontward-rearward direction may be adjusted.

In the seat slide apparatus for a vehicle according to the second embodiment, each of the lower rails **102** is retained on the floor portion F of the vehicle via a base bracket **104**. Furthermore, a side frame **105** that forms a framework of a seat cushion is arranged on each of the upper rails **103**.

More specifically, as FIGS. **16** to **18** illustrate, the side frame **105** of the seat slide apparatus for a vehicle according to the second embodiment, is formed in a flat plate form having a form similar to a rectangle. The side frame **105** erects on the upper rail **103** such that a longitudinal direction of the side frame **105** conforms to an elongating direction of the upper rail **103** and the elongating direction of the lower rail **102**. Note that the elongating direction refers to a leftward-rightward direction in FIGS. **17** and **18**.

As FIG. **19** illustrates, a form of the lower rail **102** of the seat slide apparatus for a vehicle according to the second embodiment is similar to the form of the lower rail **5** of the seat slide apparatus for a vehicle according to the first embodiment. Accordingly, the lower rail **102** includes a bottom wall **102***c*, outer walls **102***d*, top walls **102***e*, and inner walls **102***f*. On the other hand, the upper rail **103** includes a body portion **103***a* that is integrally formed with the side frame **105**. In the second embodiment, similarly to the upper rail **21** of the first embodiment, a pair of protruding portions **103***b* and hook portions **103***c* are arranged at a bottom end of the body portion **103***a*, which is an end portion in a downward direction in FIG. **19**. Each of the protruding portions **103***b* is a portion that is folded outwardly in a width direction at the bottom end of the body portion **103***a*. Note that the width direction refers to a leftward-rightward direction in FIG. **19**. Each of the hook portions **103***c* is a portion that is folded upwardly from each end of the protruding portions **103***b*.

More specifically, the upper rail **103** of the seat slide apparatus for a vehicle according to the second embodiment attaches to the lower rail **102** so that the body portion **103***a* is arranged between the inner walls **102***f* of the lower rail **102**. Furthermore, similarly to the seat slide apparatus for a vehicle according to the first embodiment, by arranging each of the protruding portions **103***b* and each of the hook portions **103***c* in a space surrounded by the outer wall **102***d* of the lower rail **102**, the top wall **102***e* of the lower rail **102**, and the inner wall **102***f* of the lower rail **102**, the upper rail **103** is restrained from movement in an upward direction relative to the lower rail **102** and is restrained from movement in the width direction relative to the lower rail **102**.

Note that, in the seat slide apparatus for a vehicle according to the second embodiment, instead of having wheels **22** of the seat slide apparatus for a vehicle according to the first embodiment, a multiple number of rolling elements are arranged between the lower rail **102** and the upper rail **103**. Rolling of the rolling elements secures smooth relative movement between the lower rail **102** and the upper rail **103**.

As FIGS. **16** to **18** illustrate, a known type of seat reclining device **106** is arranged at a rearward end portion of the side frame **105**, which is a leftward end portion in FIG. **18**, similarly to the seat slide apparatus for a vehicle according to the first embodiment. A seat back is linked to the seat cushion via the seat reclining device **106** so that a state of the seat back may be switched between a state in which rotational movement relative to the seat cushion is restrained and a state in which the rotational movement relative to the seat cushion is allowed.

More specifically, the seat reclining device **106** includes an operation lever **107** protruding in a side direction of the side frame **105**. The operation lever **107** is manually operated. The seat reclining device **106** furthermore includes a foot-operated lever **108** protruding in a rearward direction of the side frame **105**. Furthermore, the seat back is biased by an elastic force of a spiral spring **109**, which is illustrated in FIG. **16**. The seat back is biased in a direction that makes the seat back tilt in a vehicle frontward direction, which is rightward in FIG. **18**. In other words, in accordance with the elastic force of the spiral spring **109**, the seat back is biased in a direction that knocks down the seat back in a frontward direction. Similarly to the seat reclining device **35** of the seat slide apparatus for a vehicle according to the first embodiment, the seat reclining device **106** of the seat slide apparatus for a vehicle according to the second embodiment is configured such that a tilting angle of the seat back may be adjusted with an operation of the operation lever **107** and the seat back may be knocked down in the vehicle frontward direction by operating the foot-operated lever **108**.

Furthermore, as FIG. **19** illustrates, similarly to the seat slide apparatus for a vehicle according to the first embodiment, the seat slide device **101** includes a lock mechanism **110** configured to restrain movement of the upper rail **103** relative to the lower rail **102**.

More specifically, the lock mechanism **110** of the seat slide apparatus for a vehicle according to the second embodiment includes a lock lever **112** having a rotation shaft **111** that conforms to an elongating direction of the lock lever **112** and retained to the upper rail **103** in a state such that the lock lever **112** may rotationally move at the rotation shaft **111**. Note that, the elongating direction of the lock lever **112** refers to a perpendicular direction relative to the surface where FIG. **19** is drawn. As FIGS. **16** and **17** illustrate, in the second embodiment, the lock lever **112** is arranged on an inner surface **105***a* of the side frame **105**. Furthermore, as FIG. **19** illustrates, at one end of the lock lever **112**, which is an end portion arranged in the downward direction in FIG. **19**, locking protrusions **112***a* configured to engage with locking through-holes **115** on the lower rail **102** are formed, similarly to the lock lever **41** of the seat slide apparatus for a vehicle according to the first embodiment.

More specifically, as FIG. **17** illustrates, in the seat slide apparatus for a vehicle according to the second embodiment, a spring member **116**, which is a helical torsion spring, is arranged to fit to the rotation shaft **111** of the lock lever **112**. Accordingly, as FIG. **19** illustrates, an elastic force of the spring member **116** rotationally biases the lock lever **112** in a direction that makes the locking protrusions **112***a* approach the locking through-holes **115** of the lower rail **102**, which is a clockwise direction in FIG. **19**.

Furthermore, on a support member **113** of the lock lever **112**, which is arranged on the side frame **105**, insertion through-holes **117** for receiving the locking protrusions **112***a*

are provided. On the protruding portions **103***b* and the hook portion **103***c* of the upper rail **103**, which are positioned in the lower rail **102** in the aforementioned arrangement, insertion through-holes **118** for receiving the locking protrusions **112***a* are provided. Accordingly, the lock mechanism **110** of the seat slide apparatus for a vehicle according to the second embodiment at a normal time is arranged to be in a state in which the locking protrusions **112***a* of the lock lever **112** and the locking through-holes **115** are engaged. In other words, the lock mechanism **110** at the normal time is in a locked state in which the lock mechanism is locked, which is a state in which the upper rail **103** is restrained from moving relative to the lower rail **102**.

Here, as FIGS. **16** and **17** illustrate, in the seat slide apparatus for a vehicle according to the second embodiment, an unlock lever **120** is arranged on the inner surface **105***a* of the side frame **105**. The unlock lever **120** is arranged at a position parallel to the inner surface **105***a*. The unlock lever **120** is provided with a rotation shaft **119**, which is positioned perpendicular to the inner surface **105***a*. The unlock lever **120** is arranged such that the unlock lever **120** is rotationally supported to the rotation shaft **119**. Note that the unlock lever **120** and the rotation shaft **119** serve as a first unlock mechanism. An end portion of a known type of operation lever **121** connects to one end of the unlock lever **120**, which is an operating end **120***a*. Note that, the one end of the unlock lever **120** refers to a leftward end portion in FIG. **17**, which in other words is an end portion of the unlock lever **120** in the vehicle frontward direction. The operation lever **121** is formed in a form similar to a U-shape. The operation lever **121** includes an operation portion **121***a* extending in a width direction of the seat at a position in the frontward direction of the seat. Furthermore, as FIG. **19** illustrates, the other end of the unlock lever **120** is arranged at a position in an upward direction relative to a lever portion **112***c*. The lever portion **112***c* is an end portion of the lock lever **112**, which is the opposite end relative to the end of the lock lever **112** at which the locking protrusions **112***a* are arranged.

As FIGS. **16** and **17** illustrate, the unlock lever **120** makes rotational movement in accordance with an operational input at the operation lever **121** that is connected to the operating end **120***a* of the unlock lever **120**. More specifically, the unlock lever **120** is rotationally biased by a spring member **123** arranged to fit to the rotation shaft **119**. The spring member **123** is a helical torsion spring. By an elastic force of the spring member **123**, the unlock lever **120** is rotationally biased in a direction that makes a pushing end **120***b* of the unlock lever **120** move in the upward direction, which is a counterclockwise direction in FIG. **17**. In a state where an operator operates the operation lever **121**, the pushing end **120***b* makes rotational movement in the downward direction, which is a clockwise direction in FIG. **17**.

As FIG. **19** illustrates, the unlock lever **120** of the seat slide apparatus for a vehicle according to the second embodiment is arranged at a position such that the pushing end **120***b* of the unlock lever **120** pushes the lever portion **112***c* of the lock lever **112** downwardly, which is in the downward direction in FIG. **19**, by the rotational movement in accordance with the operational input at the operation lever **121**. More specifically, the lock lever **112** of the second embodiment makes rotational movement in a direction that makes the locking protrusions **112***a* detach from the locking through-holes **115** on the lower rail **102** in a state where the lever portion **112***c* of the lock lever **112** is pushed in the downward direction. Note that, the direction that makes the locking protrusions **112***a* detach from the locking through-holes **115** on the lower rail **102** is the counterclockwise direction in FIG. **19**. Accordingly, the locking protrusions **112***a* and the locking through-holes **115** are disengaged so that the lock mechanism **110** of the second embodiment is operated into an unlocked state in which the lock mechanism **110** is unlocked, which is a state in which movement of the upper rail **103** relative to the lower rail **102** is allowed.

A walk-in function of the seat slide apparatus for a vehicle according to the second embodiment will be described next.

As FIGS. **16** and **18** illustrate, the seat slide device **101** of the seat slide apparatus for a vehicle according to the second embodiment is provided with an unlocked state retaining mechanism **130** similarly to the seat slide apparatus for a vehicle according to the first embodiment. The unlocked state retaining mechanism **130** unlocks the lock mechanism **110** in conjunction with an operation to knock down the seat back in the frontward direction and retains the lock mechanism **110** in the unlocked state.

More specifically, as FIG. **19** illustrates, in the seat slide apparatus for a vehicle according to the second embodiment, the side frame **105** is formed with an insertion through-hole **131** extending through the side frame **105** in a thickness direction at a position corresponding to the rotation shaft **111** of the lock lever **112**. Note that, the thickness direction is the leftward-rightward direction in FIG. **19**. Furthermore, the lever portion **112***c* of the lock lever **112** is configured to protrude in a direction of an outer surface **105***b* of the side frame **105** from the direction of the inner surface **105***a* of the side frame **105** through the insertion through-hole **131**. Note that, the direction of the inner surface **105***a* is rightward in FIG. **19**. FIG. **17** illustrates the inner surface **105***a*. Furthermore, the direction of the outer surface **105***b* is leftward in FIG. **19**. FIG. **18** illustrates the outer surface **105***b*.

On the pushing end **120***b* of the unlock lever **120**, a flange **132** is formed. The flange **132** is formed such that the flange **132** protrudes in the direction of the outer surface **105***b* of the side frame **105** from the direction of the inner surface **105***a* of the side frame **105** through the insertion through-hole **131**, similarly to the lever portion **112***c* of the lock lever **112**. Furthermore, the unlocked state retaining mechanism **130** of the seat slide apparatus for a vehicle according to the second embodiment includes a second unlock lever **140**. The second unlock lever **140** operates in conjunction with the operation to knock down the seat back in the frontward direction to push the flange **132** of the unlock lever **120** and the lever portion **112***c* of the lock lever **112** in the downward direction.

More specifically, as FIGS. **18** and **19** illustrate, the second unlock lever **140** of the seat slide apparatus for a vehicle according to the second embodiment includes a base portion **142**. The base portion **142** is arranged at a position parallel to the outer surface **105***b* of the side frame **105**. Furthermore, the base portion **142** is provided with a rotation shaft **141**, which is positioned perpendicular to the outer surface **105***b*. The base portion **142** is arranged such that the base portion **142** is rotationally supported to the rotation shaft **141**. As FIG. **19** illustrates, the base portion **142** is provided with a push protrusion **143**. The push protrusion **143** protrudes in the direction toward the inner surface **105***a* at a position in the upward direction relative to the flange **132** of the unlock lever **120**. Note that, in the second embodiment, the push protrusion **143** is provided in a state in which the push protrusion **143** penetrates through the base portion **142** in a thickness direction of the base portion **142**, which is the leftward-rightward direction in FIG. **19**.

Furthermore, as FIG. **18** illustrates, one end of a connecting member **144** connects to the base portion **142**, which is a portion of the second unlock lever **140**, The connecting member **144** is formed by processing a wire material. The con-

necting member **144** connects to the base portion **142** at a position in the downward direction relative to the rotation shaft **141**. Furthermore, at a rear end portion of the side frame **105**, a pulling lever **145** is arranged. The pulling lever **145** makes rotational movement at a time at which the seat back is knocked down in the frontward direction to pull the other end of the connecting member **144** in the rearward direction. Note that the second unlock lever **140**, the connecting member **144**, and the pulling lever **145** serve as a second unlock mechanism.

More specifically, as FIGS. **20** and **21** illustrate, at the time at which the seat back is knocked down in the frontward direction, in accordance with a pull force transmitted via the connecting member **144**, the second unlock lever **140** of the seat slide apparatus for a vehicle according to the second embodiment makes rotational movement that is in a clockwise direction in FIGS. **20** and **21**, which is a direction in which the push protrusion **143** of the second unlock lever **140** is displaced in the downward direction, as FIG. **19** illustrates. Note that, the downward direction is the downward direction in FIG. **19**. Accordingly, as FIG. **19** illustrates, the unlocked state retaining mechanism **130** of the second embodiment unlocks the lock mechanism **110** by the push protrusion **143** of the second unlock lever **140** pushing the flange **132** of the unlock lever **120** and the lever portion **112***c* of the lock lever **112** in the downward direction.

Note that, as FIG. **18** illustrates, a spring member **146**, which is a helical torsion spring, is arranged to fit to the rotation shaft **141** of the second unlock lever **140**. By an elastic force of the spring member **146**, the second unlock lever **140** is rotationally biased in a direction that displaces the push protrusion **143** in the upward direction, which is an upward direction in FIG. **19**, as FIG. **19** illustrates. Note that, the direction that displaces the push protrusion **143** in the upward direction is a counterclockwise direction in FIG. **18**. Accordingly, in the seat slide apparatus for a vehicle according to the second embodiment, the push protrusion **143** is arranged to remain at a position at which the push protrusion **143** does not interfere with the flange **132** of the unlock lever **120** at a time before which the second unlock lever **140** makes rotational movement in accordance with the operation to knock down the seat back in the frontward direction.

Furthermore, as FIGS. **18**, **20**, and **21** illustrate, the unlocked state retaining mechanism **130** of the seat slide apparatus for a vehicle according to the second embodiment includes an unlocked state retaining lever **150**. The unlocked state retaining lever **150** is arranged such that the unlocked state retaining lever **150** may make rotational movement in a state in which the unlocked state retaining lever **150** is in contact with an outer peripheral portion **140***a* of the second unlock lever **140**. After the second unlock lever **140** makes rotational movement to unlock the lock mechanism **110**, the unlocked state retaining lever **150** and the second unlock lever **140** cooperate with each other to retain the lock mechanism **110** in the state in which the lock mechanism **110** is unlocked.

More specifically, the unlocked state retaining lever **150** is arranged at a position parallel to the outer surface **105***b* of the side frame **105**, similarly to the second unlock lever **140**. The unlocked state retaining lever **150** is provided with a rotation shaft **147**, which is positioned perpendicular to the outer surface **105***b*. The unlocked state retaining lever **150** is arranged such that the unlocked state retaining lever **150** is rotationally supported to the rotation shaft **147**. Furthermore; the unlocked state retaining lever **150** includes a distal end portion **151**. With the rotation shaft **147** as the proximal end, the unlocked state retaining lever **150** extends outwardly in a radial direction toward the distal end portion **151**. Furthermore, a spring member **152** is arranged to fit to the rotation shaft **147** of the unlocked state retaining lever **150**. By an elastic force of the spring member **152**, the unlocked state retaining lever **150** is rotationally biased in a direction that makes the distal end portion **151** move from the downward direction toward the upward direction, which is a clockwise direction in FIG. **18**. Accordingly, in the seat slide apparatus for a vehicle according to the second embodiment, an outer peripheral portion **150***a* of the unlocked state retaining lever **150** is arranged to make contact with the outer peripheral portion **140***a* of the second unlock lever **140**.

More specifically, as FIG. **20** illustrates, in the seat slide apparatus for a vehicle according to the second embodiment, at a time before which the second unlock lever **140** makes rotational movement in accordance with the operation to knock down the seat back in the frontward direction, the outer peripheral portion **150***a* of the unlocked state retaining lever **150** makes contact with the outer peripheral portion **140***a* of the second unlock lever **140** at a portion in the upward direction relative to the distal end portion **151**, which is at the portion in the clockwise direction in FIG. **20** relative to the distal end portion **151**. Furthermore, as FIGS. **20** and **21** illustrate, in the second embodiment, an outer peripheral form of the second unlock lever **140** is formed such that a contact point between the second unlock lever **140** and the unlocked state retaining lever **150**, which is the contact point Q, moves in a direction that moves the contact point Q away from the rotation shaft **147** by the rotational movement in accordance with the operation to knock down the seat back in the frontward direction. Accordingly, in the second embodiment, the unlocked state retaining lever **150**, which is rotationally biased by the spring member **152**, makes rotational movement in conjunction with the rotational movement of the second unlock lever **140**.

Furthermore, as FIG. **21** illustrates, a cut-out portion **154** configured to engage with the distal end portion **151** of the unlocked state retaining lever **150** is formed on the outer peripheral portion **140***a* of the second unlock lever **140**. More specifically, by the second unlock lever **140** and the unlocked state retaining lever **150** making rotational movements in conjunction with each other in accordance with the operation to knock down the seat back in the frontward direction, the contact point Q between the second unlock lever **140** and the unlocked state retaining lever **150** seemingly moves on the outer peripheral portion **150***a* of the unlocked state retaining lever **150** toward the distal end portion **151**. In the seat slide apparatus for a vehicle according to the second embodiment, the cut-out portion **154** of the second unlock lever **140** is configured such that the cut-out portion **154** engages with the distal end portion **151** of the unlocked state retaining lever **150** in a state in which the second unlock lever **140** is at a rotational position that unlocks the lock mechanism **110**. Accordingly, in the second embodiment, the unlocked state retaining mechanism **130** at the aforementioned rotational position restrains the rotational movement of the second unlock lever **140** and the unlocked state retaining lever **150** so that the lock mechanism **110** is retained in the unlocked state, which is the state in which the lock mechanism **110** is retained in the state in which the lock mechanism **110** is unlocked.

Note that, as FIG. **18** illustrates, in the seat slide apparatus for a vehicle according to the second embodiment, a spring member **155**, which is a coil spring, is arranged between the upper rail **103** and the lower rail **102**. Accordingly, the upper rail **103** is biased by an elastic force of the spring member **155** in the vehicle frontward direction, which is rightward in FIG. **18**. As a result, in the second embodiment, the seat slide device **101** is arranged such that the seat moves in the front-

ward direction in accordance with the operation to knock down the seat back in the frontward direction.

Furthermore, as FIGS. **20** and **21** illustrate, in the seat slide apparatus for a vehicle according to the second embodiment, the unlocked state retaining mechanism **130** includes the unlocked state release lever **160** sharing the rotation shaft **147** with the unlocked state retaining lever **150** and makes rotational movement integrally with the unlocked state retaining lever **150** at the rotation shaft **147**.

More specifically, in the seat slide apparatus for a vehicle according to the second embodiment, the unlocked state release lever **160** includes an end portion **161** protruding outwardly in the radial direction. Note that the end portion **161** serves as the first end. The end portion **161** is arranged at a position spaced apart from the distal end portion **151** of the unlocked state retaining lever **150** by a predetermined angle between the end portion **161** and the distal end portion **151**. The unlocked state release lever **160** is retained at the rotation shaft **147** in a state in which the end portion **161** of the unlocked state release lever **160** is arranged at a position in the vehicle frontward direction relative to the distal end portion **151** of the unlocked state retaining lever **150**. Note that the unlocked state release lever **160**, the rotation shaft **147**, and the end portion **161** serve as a first unlocked state release mechanism.

Furthermore, as FIG. **22** illustrates, in the seat slide apparatus for a vehicle according to the second embodiment, the unlocked state retaining lever **150** and the unlocked state release lever **160** are integrally formed by processing a plate material. Accordingly, as FIGS. **20** and **21** illustrates, in a state in which the distal end portion **151** of the unlocked state retaining lever **150** makes rotational movement that displaces the distal end portion **151** in the upward direction, the end portion **161** of the unlocked state release lever **160** is displaced in the downward direction. In a state in which the distal end portion **151** of the unlocked state retaining lever **150** makes rotational movement that displaces the distal end portion **151** in the downward direction, the end portion **161** of the unlocked state release lever **160** is displaced in the upward direction.

Note that, as FIG. **18** illustrates, in the seat slide apparatus for a vehicle according to the second embodiment, a sensor bracket **163** extending in the elongating direction of the lower rail **102** is fixed on the lower rail **102** in a state in which the sensor bracket **163** covers the outer wall **102***d* and the top wall **102***e* of the lower rail **102**, as FIG. **19** illustrates. Note that, the sensor bracket **163** serves as the operation body. Furthermore, the unlocked state release lever **160** is arranged at a position at which the end portion **161** may come into contact with a frontward end portion **163***a* of the sensor bracket **163** by the upper rail **103** moving in the vehicle rearward direction relative to the lower rail **102** in a state where the lock mechanism **110** is retained in the unlocked state in accordance with the operation to knock down the seat back in the frontward direction, which is the state illustrated in FIG. **21**. Accordingly, in the second embodiment, the unlocked state retaining mechanism **130** is configured such that the lock mechanism **110** is released from the state in which the lock mechanism **110** is retained in the unlocked state by the unlocked state retaining lever **150** making rotational movement integrally with the unlocked state release lever **160**.

More specifically, as FIG. **20** illustrates, in the seat slide apparatus for a vehicle according to the second embodiment, the end portion **161** of the unlocked state release lever **160** is arranged at a position in the upward direction relative to the sensor bracket **163** at a time before the unlocked state release lever **160** makes rotational movement in conjunction with the second unlock lever **140** by the operation to knock down the seat back in the frontward direction. Two-dot chain line U in each of FIG. **20** and FIG. **21** indicates a position of the sensor bracket **163**. As FIG. **21** illustrates, the end portion **161** is arranged at a position in the downward direction relative to the position of the sensor bracket **163** in a state in which the unlocked state release lever **160** makes the rotational movement in conjunction with the second unlock lever **140** by the operation to knock down the seat back in the frontward direction.

Note that, at a time at which the operation to knock down the seat back in the frontward direction is operated at a seat slide position at which the end portion **161** of the unlocked state release lever **160** is at a position in the rearward direction relative to the frontward end portion **163***a* of the sensor bracket **163**, the end portion **161** of the unlocked state release lever **160** makes contact with a top surface **163***b* of the sensor bracket **163**. In the seat slide apparatus for a vehicle according to the second embodiment, the seat is configured to move in the vehicle frontward direction in a state in which the end portion **161** of the unlocked state release lever **160** slides on the top surface **163***b* of the sensor bracket **163** in a state in which the end portion **161** is in contact with the top surface **163***b*.

More specifically, in the seat slide apparatus for a vehicle according to the second embodiment, the unlocked state retaining mechanism **130** is configured such that the unlocked state release lever **160** of the unlocked state retaining mechanism **130** remains at a position that does not interfere with the sensor bracket **163** at a time of normal seat sliding operation using the operation lever **121**, which is in a state in which the second unlock lever **140** has not made rotational movement in accordance with the operation to knock down the seat back in the frontward direction, which is the state illustrated in FIG. **20**.

On the other hand, at a time at which the walk-in function is operated by the operation to knock down the seat back in the frontward direction, the end portion **161** of the unlocked state release lever **160** makes contact with the frontward end portion **163***a* of the sensor bracket **163**, which serves as the operation body, by moving the seat that has moved in the vehicle frontward direction to a position in the vehicle rearward direction by moving the upper rail **103** in the rearward direction relative to the lower rail **102**. As a result, the unlocked state release lever **160**, which serves as the first unlocked state release mechanism, and the unlocked state retaining lever **150** integrally make rotational movement and the distal end portion **151** of the unlocked state retaining lever **150** disengages from the cut-out portion **154** of the second unlock lever **140**. Accordingly, the lock mechanism **110** is released from the state in which the lock mechanism **110** is retained in the unlocked state, so that the seat is retained at a predetermined position in a sliding range.

Furthermore, as FIG. **18** illustrates, in the seat slide apparatus for a vehicle according to the second embodiment, the insertion through-hole **131** that extends through the side frame **105** in a thickness direction, which is the leftward-rightward direction in FIG. **19**, extends to a position that corresponds to the distal end portion **151** of the unlocked state retaining lever **150**. As FIGS. **22**, **23**, and **24** illustrate, the distal end portion **151** of the unlocked state retaining lever **150** is arranged with a flange **165** protruding in the direction toward the inner surface **105***a* of the side frame **105** from the direction of the outer surface **105***b* of the side frame **105** through the insertion through-hole **131**. Note that, the outer surface **105***b* refers to a rightward surface in FIG. **24** and the inner surface **105***a* refers to a leftward surface in FIG. **24**.

More specifically, as FIG. **24** illustrates, an end portion **165***a* of the flange **165** extends to a position that interacts with the unlock lever **120**, which is arranged at a position in a direction of the inner surface **105***a* of the side frame **105**. To be more specific, as FIGS. **25** and **26** illustrate, at a time at which the operation lever **121** is operated to provide the operational input in a state where the lock mechanism **110** is retained in the unlocked state in response to the operation to knock down the seat back in the frontward direction, the unlock lever **120** is arranged to rotationally move to push the flange **165** in the downward direction, as FIGS. **27** and **28** illustrate. Accordingly, in the seat slide apparatus for a vehicle according to the second embodiment, the unlocked state retaining lever **150** makes rotational movement that makes the distal end portion **151** of the unlocked state retaining lever **150** detach from the cut-out portion **154** of the second unlock lever **140**.

In the seat slide apparatus for a vehicle according to the second embodiment, the flange **165** and the unlock lever **120** serve as a second unlocked state release mechanism. By rotational movement in accordance with the operational input at the operation lever **121**, the unlock lever **120** pushes the unlocked state retaining lever **150** and moves the unlocked state retaining lever **150** to a rotational position at which the lock mechanism **110** is released from the state in which the lock mechanism **110** is retained in the unlocked state, so that the lock mechanism **110** is released from the state in which the lock mechanism **110** is retained in the unlocked state.

More specifically, as FIG. **23** illustrates, in the seat slide apparatus according to the second embodiment, the unlock lever **120** is formed with a cut-out portion **167** with an opening facing downward, which is the downward direction in FIG. **23**. The cut-out portion **167** is formed at a position in a direction toward a proximal end of the unlock lever **120** relative to the flange **132**. The flange **132**, which is illustrated in FIG. **19**, is the portion of the unlock lever **120** that is pushed in the downward direction by the push protrusion **143** of the second unlock lever **140**. The direction toward the proximal end of the unlock lever **120** refers to rightward in FIG. **23**. In the second embodiment, an inner wall surface of the cut-out portion **167** in the upward direction is a push portion **170** at which pushes down the flange **165** of the unlocked state retaining lever **150**.

More specifically, in the seat slide apparatus according to the second embodiment, the pushing end **120***b* of the unlock lever **120** is formed in the aforementioned form. Accordingly, the push portion **170** that pushes the flange **165** of the unlocked state retaining lever **150** downwardly is arranged at a position that is in the upward direction relative to the flange **132** that is pushed downwardly by the second unlock lever **140**. Accordingly, as FIGS. **23** and **24** illustrate, the push portion **170** is configured such that the push portion **170** remains at a position that does not interfere with the flange **165** at a time before the second unlock lever **140** makes rotational movement in accordance with the operation to knock down the seat back in the frontward direction, which in other words is in a state where the second unlock lever **140** is not at a position to push the unlock lever **120**.

In other words, in the seat slide apparatus for a vehicle according to the second embodiment, as FIGS. **25** and **26** illustrate, the push portion **170** of the unlock lever **120** pushes the flange **165** of the unlocked state retaining lever **150** downwardly on condition that the lock mechanism **110** is retained in the unlocked state and the unlock lever **120** is furthermore rotated to a full stroke state by the operational input at the operation lever **121**. Accordingly, as FIGS. **27** and **28** illustrate, the unlocked state retaining lever **150** makes rotational movement to a position that disengages the distal end portion **151** of the unlocked state retaining lever **150** from the cut-out portion **154** of the second unlock lever **140** so that the lock mechanism **110** may be released from the state in which the lock mechanism **110** is retained in the unlocked state.

Note that, a two-dot chain line N**0** in FIG. **28** indicates a position of the push portion **170** at a time at which the lock mechanism **110** is in the locked state, which is the state in which the lock mechanism **110** is locked, and the operation lever **121** is not operated. A two-dot chain line N**1** in FIG. **28** indicates the position of the push portion **170** at a time at which the lock mechanism **110** is in a state in which the lock mechanism **110** is retained in the unlocked state and the operation lever **121** is not operated. Furthermore, a two-dot chain line N**2** in FIGS. **24** and **28** indicates the position of the push portion **170** at a time at which the unlock lever **120** is operated to the full stroke state by the operational input at the operation lever **121**.

Accordingly, in the seat slide apparatus for a vehicle according to the second embodiment, by an operator operating the operation lever **121**, the lock mechanism **110** may be released from the state in which the lock mechanism **110** is retained in the unlocked state at a selected position during sliding movement even at a time before the seat is moved in the vehicle rearward direction to a position at which the unlocked state release lever **160** makes contact with the sensor bracket **163** after the seat is moved in the vehicle frontward direction by operating the walk-in function. As a result, similarly to the seat slide apparatus for a vehicle according to the first embodiment, a seat position may be adjusted with easier operation and with more convenience.

In addition, in a state where the second unlock lever **140** is not at a position to push the unlock lever **120**, the push portion **170** is arranged not to interfere with the flange **165** even with the operational input at the operation lever **121**. Accordingly, at a time at which the lock mechanism **110** is unlocked by the operation at the operation lever **121** in the normal seat sliding operation, the second unlock lever **140** and the unlocked state retaining lever **150** do not make rotational movement. As a result, a false operation may be prevented to secure high reliability of the seat sliding operation. Furthermore, a noise that is generated by the unlock lever **120** making contact with the unlocked state retaining lever **150** may be prevented so that the seat slide apparatus may be operated with an operational noise kept at a low level.

The seat slide apparatus for a vehicle according to the first embodiment and the second embodiment may be altered in following manners. In the first embodiment, the seat slide apparatus for a vehicle is applied to the vehicle seat **1**, which is the seat that may be divided into the seat **11** and the seat **12**, which are a pair of seats separated into a rightward seat and a leftward seat. The vehicle seat **1** is provided as a rear seat. More specifically, the vehicle seat **1** is provided as a second row seat. Nevertheless, the seat slide apparatus for a vehicle may be similarly applied to a driver seat or to a front passenger seat. Furthermore, the seat slide apparatus for a vehicle may be similarly applied to a third row seat and seats behind the third row.

In the first embodiment, the lock mechanism **40** is arranged such that each upper rail **21** is provided with two lock levers, which are the lock lever **41**A and the lock lever **41**B. The lock lever **41**A and the lock lever **41**B are arranged in the direction that conforms to the longitudinal direction of the upper rail **21**. Nevertheless, the number of lock lever **41** on each upper rail **21** may be altered appropriately. For example one lock lever **41** may be arranged on each upper rail **21** instead,

Furthermore, characteristics of the lock lever **41**, for example form and movement, may be altered appropriately.

In the first embodiment, the second unlock lever **61** makes rotational movement by the pull force generated by the pulling portion **64** pulling the wire **63** at the time at which the seat back is knocked down in the frontward direction. Furthermore, together with the second unlock lever **61**, the unlock levers **50** including the unlock lever **50**A make rotational movement, which in turn push the lock levers **41** including the lock lever **41**A downwardly so that the lock mechanism **40** is unlocked. The configuration to unlock the lock mechanism **40** is not limited to the above-described configuration. A configuration of the second unlock mechanism that by pushing the unlock lever **50** and makes the lock mechanism **40** rotationally move in the direction to unlock may be altered appropriately.

More specifically, the second unlock mechanism may be configured to unlock the lock mechanism **40** by a selected seat operation instead of by the operation to knock down the seat back in the frontward direction. For example, an input device similar to an operation lever or a switch, which is operated by an operator, may be provided to unlock the lock mechanism **40** and to retain the lock mechanism **40** in the unlocked state. The lock mechanism **40** may be unlocked by an operational input at such operation lever or a switch. Note that, in such case, the seat back **3** may remain upright instead of being knocked down in the frontward direction similarly to a time at which a common walk-in function is operated. Similarly, the second unlock mechanism may be altered appropriately to unlock the lock mechanism **110** in the second embodiment. The lock mechanism **110** may be unlocked by a predetermined seat operation instead of by an operation to knock down the seat back in the frontward direction.

In the first embodiment, the unlocked state retaining lever **66** is arranged to make rotational movement at a position at which the end portion **66***a* of the unlocked state retaining lever **66** and the action bar **71***a* of the unlocked state release lever **71** intersect by rotational movement of the unlocked state release lever **71**. Nevertheless, a configuration of the unlocked state retaining lever **66** is not limited to the aforementioned configuration and may be altered appropriately on condition that the unlocked state retaining lever **66** is configured to retain the lock mechanism **40** in the state in which the lock mechanism **40** is unlocked by cooperating with the second unlock mechanism by moving to a position that retains the lock mechanism **40** in the unlocked state by operating in conjunction with the second unlock mechanism and, furthermore, configured to move in the direction to release the lock mechanism **40** from the state in which the lock mechanism **40** is retained in the unlocked state by the unlocked state release lever **71** pushing the unlocked state retaining lever **66**. For example, the unlocked state retaining lever **66** may move to the position where the lock mechanism **40** is retained in the unlocked state by making swinging movement instead of by making rotational movement. Furthermore, a form of the unlocked state retaining lever **66** may be altered appropriately.

In the first embodiment, as FIG. **8** illustrates, the rotation shaft **46**, which becomes the center of rotational movement L for the second unlock lever **61**, is arranged to extend in the direction that is substantially perpendicular to the two upper rails **21**. Furthermore, the unlocked state retaining lever **66** includes the rotation shaft **67** arranged substantially parallel to the center of rotational movement L. In addition, the unlocked state release lever **71** includes the rotation shaft **72** extending in the upward-downward direction at a position skew to the rotation shaft **67** of the unlocked state retaining lever **66**. Nevertheless, the directions in which the unlocked state retaining lever **66** and the rotation shaft **67** extend and the directions in which the unlocked state release lever **71** and the rotation shaft **72** extend are not limited to the aforementioned directions and may be appropriately altered, for example, by an alteration made to a positional arrangement of the unlocked state retaining mechanism **60**.

In the first embodiment, the rotational direction in which the action bar **71***a* moves toward the vehicle frontward direction is referred to as the first direction and the rotational direction in the opposite direction relative to the first direction is referred to as the second direction. Nevertheless, the definition of the first direction in this case is not limited to the aforementioned direction.

In the first embodiment, the unlocked state release lever **71** is configured such that the rotation operation portion **74** of the unlocked state release lever **71** protrudes from the housing cover **75** in a side direction of the seat **11**, which is the side direction of the side shield **31**, by the unlocked state release lever **71** making rotational movement in the first direction. Furthermore, on the side shield **77** of the seat **12**, which is the seat that is arranged adjacent to the seat **11** in the side direction, the operation protrusion **78**, which serves as the operation body, is provided. Nevertheless, arrangement of the operation body is not limited at the aforementioned position. The operation body may be arranged at a non-moving portion of the vehicle at which the position relative to the upper rail **21** changes by movement of the upper rail **21** relative to the lower rail **5**, which is a portion similar to the floor portion F of the vehicle, the lower rail **5**, and an inner wall of a vehicle interior.

More specifically, as FIG. **29** illustrates, the unlocked state release lever **71** may be arranged such that the operation bar **71***b* and the rotation operation portion **74** of the unlocked state release lever **71** extends in an inward direction of a seat, which is a downward direction in FIG. **29**. In FIG. **1**, the inward direction refers to a direction toward inside portion of the side shield **31**. Furthermore, an operation protrusion **79**, which serves as the operation body, is arranged on the floor portion F of the vehicle, which is an example of the non-moving portion of the vehicle. The operation protrusion **79** is configured to make contact with the rotation operation portion **74** by a seat sliding operation.

As examples of arrangements to make the operation protrusion **79** contact with the rotation operation portion **74**, the operation protrusion **79** may be arranged on a trajectory of the rotation operation portion **74**, the trajectory that corresponds to movement of the upper rail **21** relative to the lower rail **5**. Furthermore, the operation bar **71***b* may be bent so that the rotation operation portion **74** is arranged close to the floor portion F. The configuration may be altered on condition that the unlocked state release lever **71** makes rotational movement in the first direction in conjunction with the unlocked state retaining lever **66** that moves to the position where the lock mechanism **40** is retained in the unlocked state and on condition that the operation body makes contact with the rotation operation portion **74** in the direction that conforms to the direction in which the upper rail **21** moves relative to the lower rail **5**.

In the first embodiment, each of the seat **11** and the seat **12** is provided with two lower rails **5** as a set and with two upper rails **21**, accordingly. Nevertheless, number of rails for each seat may be one or may be three or more.

In the first embodiment, the second unlocked state release lever **81** is configured to push the protruding portion to be pushed **82** arranged on the unlocked state retaining lever **66**,

however, the second unlocked state release lever **81** may be configured to push a portion other than the protruding portion to be pushed **82**.

In the first embodiment, the helical torsion spring **73** is fitted to the rotation shaft **72** as the elastic member so that the unlocked state release lever **71** is biased in the second direction, however, a similar elastic member, for example, a plate spring may be used instead of a helical torsion spring. Similarly, in the second embodiment, each of the spring members **116**, **123**, **146**, **152** or similar spring members may be altered to an elastic member other than a helical torsion spring.

In the second embodiment, the unlocked state retaining lever **150** and the unlocked state release lever **160** are integrally formed by processing a plate material. Nevertheless, on condition that the unlocked state retaining lever **150** and the unlocked state release lever **160** include and share the rotation shaft **147** and integrally make rotational movement thereat, the unlocked state retaining lever **150** and the unlocked state release lever **160** may be altered to be formed as separate bodies.

In the first embodiment, the operational input at the operation lever **48** that protrudes in the side direction of the side shield **32** is converted to rotational movements of the unlock levers **50** and the rotation shafts **46**, **47** by the link mechanism **49**. Note that the unlock levers **50**, rotation shafts **46**, **47** and the link mechanism **49** serve as the first unlock mechanism, Furthermore, in the second embodiment, the operation lever **121** having the operation portion **121***a* that extends in the width direction of the seat at the position in the frontward direction of the seat is configured to connect to the one end of the unlock lever **120** that makes rotational movement at the rotation shaft **119**. Note that the unlock lever **120** and the rotation shaft **119** serves as the first unlock mechanism. Nevertheless, the configuration of the first unlock mechanism may be altered appropriately, on condition that the first unlock mechanism includes an unlock lever that rotationally moves by an operational input at an operation lever.

Technical ideas that may be obtained from the seat slide apparatus for a vehicle according to the embodiments described in this disclosure will be described next. The seat slide apparatus for a vehicle is characterized by the second unlock mechanism including the second unlock lever **61**, **140**. The second unlock lever **61**, **140** pushes the unlock lever **50**, **50**A, **120** by making rotational movement in accordance with a predetermined seat operation. Furthermore, the seat slide apparatus for a vehicle is characterized by the unlocked state retaining lever **66**, **150** retaining the lock mechanism **40**, **110** at a position of the unlocked state by the unlocked state retaining lever **66**, **150** making rotational movement in conjunction with movement of the second unlock lever **61**, **140** and engaging with the second unlock lever **61**, **140**. Furthermore, the seat slide apparatus for a vehicle is characterized by the second unlocked state release mechanism configured to push the unlocked state retaining lever **66**, **150** to a position where the unlocked state retaining lever **66**, **150** disengages from the second unlock lever **61**, **140**.

The seat slide apparatus for a vehicle is characterized by the first unlocked state release mechanism including an unlocked state release lever **71**, **160** making rotational movement integrally with the unlocked state retaining lever **66**, **150** by the first end of the unlocked state release lever **71**, **160** coming into contact with the operation body to rotationally move the unlocked state retaining lever **66**, **150** to a position where the unlocked state retaining lever **66**, **150** disengages from the second unlock lever **61**, **140**.

The seat slide apparatus for a vehicle is characterized by the second unlocked state release mechanism arranged with the unlock lever **120** to push the unlocked state retaining lever **150** to rotationally move the unlocked state retaining lever **150** to a position where the unlocked state retaining lever **150** disengages from the second unlock lever **140**.

According to an aspect of this disclosure, the seat slide apparatus for a vehicle includes a lower rail **5**, **102** configured to be retained on a floor portion F of the vehicle, an upper rail **21**, **103** configured to retain a vehicle seat **1** including a seat **11** and a seat **12**, the upper rail **21**, **103** configured to move relative to the lower rail **5**, **102**, a lock mechanism **40**, **110** configured to restrain movement of the upper rail **21**, **103** relative to the lower rail **5**, **102**, a first unlock mechanism (a rotation shaft **46**, **47**, **119**, a link mechanism **49**, an unlock lever **50**, **50**A, **120**) including an unlock lever **50**, **50**A, **120** making rotational movement in response to an operational input at an operation lever **48**, **121**, the first unlock mechanism (the rotation shaft **46**, **47**, **119**, the link mechanism **49**, the unlock lever **50**, **50**A, **120**) operating the lock mechanism **40**, **110** to unlock by the rotational movement of the unlock lever **50**, **50**A, **120**, a second unlock mechanism (a second unlock lever **61**, **140**, a wire **63**, a connecting member **144**, a pulling portion **64**, a pulling lever **145**) making the unlock lever **50**, **50**A, **120** rotationally move in a direction that unlocks the lock mechanism **40**, **110** by pushing the unlock lever **50**, **50**A, **120** in accordance with a predetermined seat operation, an unlocked state retaining lever **66**, **150** configured to retain the lock mechanism **40**, **110** in an unlocked state cooperating with the second unlock mechanism (the second unlock lever **61**, **140**, the wire **63**, the connecting member **144**, the pulling portion **64**, the pulling lever **145**) by operating in conjunction with the second unlock mechanism (the second unlock lever **61**, **140**, the wire **63**, the connecting member **144**, the pulling portion **64**, and the pulling lever **145**) to move to a position where the lock mechanism **40**, **110** is retained in the unlocked state, a first unlocked state release mechanism (an unlocked state release lever **71**, **160**, a rotation shaft **72**, **147**, a helical torsion spring **73**, a rotation operation portion **74**, an end portion **161**) moving the unlocked state retaining lever **66**, **150** to a position where the lock mechanism **40**, **110** is released from being retained in the unlocked state by making contact with an operation body (an operation protrusion **78**, **79**, a sensor bracket **163**) in accordance with movement of the upper rail **21**, **103** relative to the lower rail **5**, **102**, and a second unlocked state release mechanism (a second unlocked state release lever **81**, a protruding portion to be pushed **82**, the unlock lever **120**, a flange **165**) moving the unlocked state retaining lever **66**, **150** to a position where the lock mechanism **40**, **110** is released from being retained in the unlocked state by pushing the unlocked state retaining lever **66**, **150** in accordance with the operational input.

Accordingly, the seat slide apparatus for a vehicle may be released from the state in which the lock mechanism **40**, **110** is retained in the unlocked state at a selected position during sliding movement. The lock mechanism **40**, **110** may be released from the state in which the lock mechanism **40**, **110** is retained in the unlocked state at a selected position during sliding movement even at a time before which the first unlocked state release mechanism (the unlocked state release lever **71**, **160**, the rotation shaft **72**, **147**, the helical torsion spring **73**, the rotation operation portion **74**, the end portion **161**) makes contact with the operation body (the operation protrusion **78**, **79**, the sensor bracket **163**) in accordance with movement of the upper rail **21**, **103** relative to the lower rail **5**, **102** and moves the unlocked state retaining lever **66**, **150** to a position that releases the lock mechanism **40**, **110** from the state in which the lock mechanism **40**, **110** is retained in the

unlocked state. As a result, a seat position may be adjusted with easier operation and with more convenience.

According to another aspect of this disclosure, the first unlocked state release mechanism (the unlocked state release lever **71**, the rotation shaft **72**, the helical torsion spring **73**, the rotation operation portion **74**) of the seat slide apparatus for a vehicle includes an unlocked state release lever **71** making rotational movement by a first end (the rotation operation portion **74**) of the unlocked state release lever **71** coming into contact with the operation body (the operation protrusion **78**, **79**) and a second end (an action bar **71***a*) of the unlocked state release lever **71** pushing the unlocked state retaining lever **66** in a direction that releases the lock mechanism **40** from being retained in the unlocked state. Furthermore, the second unlocked state release mechanism (the second unlocked state release lever **81**, the protruding portion to be pushed **82**) of the seat slide apparatus for a vehicle includes a second unlocked state release lever **81** making rotational movement integrally with the unlock lever **50**, **50**A in accordance with the operational input and pushing the unlocked state retaining lever **66** in the direction that releases the lock mechanism **40** from being retained in the unlocked state.

Accordingly, the unlocked state retaining lever **66** may be reliably pushed in the direction that releases the lock mechanism **40** from the state in which the lock mechanism **40** is retained, in the unlocked state in accordance with the operational input at the operation lever **48**.

According to further aspect of this disclosure, the second unlocked state release mechanism **120**, **165** of the seat slide apparatus for a vehicle is configured with the unlock lever **120** to push the unlocked state retaining lever **150** in a direction that releases the lock mechanism **110** from being retained in the unlocked state in accordance with the operational input.

Accordingly, the unlocked state retaining lever **150** may be reliably pushed in the direction that releases the lock mechanism **110** from the state in which the lock mechanism **110** is retained in the unlocked state in accordance with the operational input at the operation lever **121**.

According to another aspect of this disclosure, the second unlocked state release mechanism (the second unlocked state release lever **81**, the protruding portion to be pushed **82**, the unlock lever **120**, the flange **165**) of the seat slide apparatus for a vehicle remains at a position where the second unlocked state release mechanism (the second unlocked state release lever **81**, the protruding portion to be pushed **82**, the unlock lever **120**, the flange **165**) does not interfere with the unlocked state retaining lever **66**, **150** at the time of the operational input at the operation lever **48**, **121** in a state where the second unlock mechanism (a second unlock lever **61**, **140**, a wire **63**, a connecting member **144**, a pulling portion **64**, a pulling lever **145**) is not pushing the unlock lever **50**, **50**A, **120**.

Accordingly, at a time at which the lock mechanism **40**, **110** is unlocked by an operation at the operation lever **48**, **121** in a normal seat sliding operation, the unlocked state retaining lever **66**, **150** does not make rotational movement. As a result, a false operation may be prevented to secure high reliability of the seat sliding operation. Furthermore, a noise that is generated by the second unlocked state release mechanism (the second unlocked state release lever **81**, the unlock lever **120**) making contact with the unlocked state retaining lever **66**, **150** may be prevented so that the seat slide apparatus for a vehicle may be operated with an operational noise kept at a low level.

According to further aspect of this disclosure, the predetermined seat operation of the seat slide apparatus for a vehicle is an operation to knock down a seat back **3** in a frontward direction.

Accordingly, the walk-in function may be used with an operation similar to that of many conventional seat slide apparatus.

According to another aspect of this disclosure, the second unlock mechanism (the second unlock lever **61**, **140**, the wire **63**, the connecting member **144**, the pulling portion **64**, the pulling lever **145**) of the seat slide apparatus for a vehicle includes a second unlock lever **61**, **140** pushing the unlock lever **50**, **50**A, **120** by making rotational movement in response to the predetermined seat operation. Furthermore, the unlocked state retaining lever **66**, **150** of the seat slide apparatus for a vehicle retains the lock mechanism **40**, **110** at a position where the lock mechanism **40**, **110** is in the unlocked state by making rotational movement in conjunction with movement of the second unlock lever **61**, **140** and engaging with the second unlock lever **61**, **140**. Furthermore, the second unlocked state release mechanism (the second unlocked state release lever **81**, the protruding portion to be pushed **82**, the unlock lever **120**, the flange **165**) of the seat slide apparatus for a vehicle pushes the unlocked state retaining lever **66**, **150** to move rotationally to a position where the unlocked state retaining lever **66**, **150** disengages from the second unlock lever **61**, **140**.

Accordingly, the seat slide apparatus for a vehicle may be released from the state in which the lock mechanism **40**, **110** is retained in the unlocked state at a selected position during sliding movement. The lock mechanism **40**, **110** may be released from the state in which the lock mechanism **40**, **110** is retained in the unlocked state at a selected position during sliding movement even at a time before which the first unlocked state release mechanism (the unlocked state release lever **71**, **160**, the rotation shaft **72**, **147**, the helical torsion spring **73**, the rotation operation portion **74**, the end portion **161**) makes contact with the operation body (the operation protrusion **78**, **79**, the sensor bracket **163**) in accordance with movement of the upper rail **21**, **103** relative to the lower rail **5**, **102** and moves the unlocked state retaining lever **66**, **150** to a position that releases the lock mechanism **40**, **110** from the state in which the lock mechanism **40**, **110** is retained in the unlocked state. As a result, a seat position may be adjusted with easier operation and with more convenience.

According to further aspect of this disclosure, the first unlocked state release mechanism (the unlocked state release lever **71**, **160**, the rotation shaft **72**, **147**, the helical torsion spring **73**, the rotation operation portion **74**, the end portion **161**) of the seat slide apparatus for a vehicle includes the unlocked state release lever **71**, **160** making rotational movement integrally with the unlocked state retaining lever **66**, **150** by the first end (the rotation operation portion **74**, an end portion **161**) of the unlocked state release lever **71**, **160** coming into contact with the operation body **78**, **79**, **163** to rotationally move the unlocked state retaining lever **66**, **150** to a position where the unlocked state retaining lever **66**, **150** disengages from the second unlock lever **61**, **140**.

Accordingly, the unlocked state retaining lever **66**, **150** may be reliably pushed in the direction that releases the lock mechanism **40**, **110** from the state in which the lock mechanism **40**, **110** is retained in the unlocked state in accordance with the operational input at the operation lever **48**, **121**.

According to another aspect of this disclosure, the second unlocked state release mechanism **120**, **165** of the seat slide apparatus for a vehicle is configured with the unlock lever **120** to push the unlocked state retaining lever **150** to rotationally move the unlocked state retaining lever **150** to a position where the unlocked state retaining lever **150** disengages from a second unlock lever **140**.

Accordingly, the unlocked state retaining lever **150** may be reliably pushed in the direction that releases the lock mechanism **110** from the state in which the lock mechanism **110** is retained in the unlocked state in accordance with the operational input at the operation lever **121**.

The principles, preferred embodiment and mode of operation of the present invention have been described in the foregoing specification. However, the invention which is intended to be protected is not to be construed as limited to the particular embodiments disclosed. Further, the embodiments described herein are to be regarded as illustrative rather than restrictive, Variations and changes may be made by others, and equivalents employed, without departing from the spirit of the present invention. Accordingly, it is expressly intended that all such variations, changes and equivalents which fall within the spirit and scope of the present invention as defined in the claims, be embraced thereby.

The invention claimed is:

**1**. A seat slide apparatus for a vehicle, comprising:
- a lower rail configured to be retained on a floor portion of the vehicle;
- an upper rail configured to retain a seat, the upper rail configured to move relative to the lower rail;
- a lock mechanism configured to restrain movement of the upper rail relative to the lower rail;
- a first unlock mechanism including an unlock lever making rotational movement in response to an operational input at an operation lever, the first unlock mechanism operating the lock mechanism to unlock by the rotational movement of the unlock lever;
- a second unlock mechanism making the unlock lever rotationally move in a direction that unlocks the lock mechanism by pushing the unlock lever in accordance with a predetermined seat operation;
- an unlocked state retaining lever configured to retain the lock mechanism in an unlocked state cooperating with the second unlock mechanism by operating in conjunction with the second unlock mechanism to move to a position where the lock mechanism is retained in the unlocked state;
- a first unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from being retained in the unlocked state by making contact with an operation body in accordance with movement of the upper rail relative to the lower rail; and
- a second unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from being retained in the unlocked state by pushing the unlocked state retaining lever in accordance with the operational input, wherein
- the first unlocked state release mechanism includes an unlocked state release lever making rotational movement by a first end of the unlocked state release lever coming into contact with the operation body and a second end of the unlocked state release lever pushing the unlocked state retaining lever in a direction that releases the lock mechanism from being retained in the unlocked state, and wherein
- the second unlocked state release mechanism includes a second unlocked state release lever making rotational movement integrally with the unlock lever in accordance with the operational input and pushing the unlocked state retaining lever in the direction that releases the lock mechanism from being retained in the unlocked state.

**2**. A seat slide apparatus for a vehicle, comprising:
- a lower rail configured to be retained on a floor portion of the vehicle;
- an upper rail configured to retain a seat, the upper rail configured to move relative to the lower rail;
- a lock mechanism configured to restrain movement of the upper rail relative to the lower rail;
- a first unlock mechanism including an unlock lever making rotational movement in response to an operational input at an operation lever, the first unlock mechanism operating the lock mechanism to unlock by the rotational movement of the unlock lever;
- a second unlock mechanism making the unlock lever rotationally move in a direction that unlocks the lock mechanism by pushing the unlock lever in accordance with a predetermined seat operation;
- an unlocked state retaining lever configured to retain the lock mechanism in an unlocked state cooperating with the second unlock mechanism by operating in conjunction with the second unlock mechanism to move to a position where the lock mechanism is retained in the unlocked state;
- a first unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from being retained in the unlocked state by making contact with an operation body in accordance with movement of the upper rail relative to the lower rail; and
- a second unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from being retained in the unlocked state by pushing the unlocked state retaining lever in accordance with the operational input,
- wherein the second unlocked state release mechanism is configured with the unlock lever to push the unlocked state retaining lever in a direction that releases the lock mechanism from being retained in the unlocked state in accordance with the operational input.

**3**. The seat slide apparatus for a vehicle according to claim **1**, wherein the second unlocked state release mechanism is configured with the unlock lever to push the unlocked state retaining lever in the direction that releases the lock mechanism from being retained in the unlocked state in accordance with the operational input.

**4**. The seat slide apparatus for a vehicle according to claim **1**, wherein the second unlocked state release mechanism remains at a position where the second unlocked state release mechanism does not interfere with the unlocked state retaining lever at a time of the operational input at the operation lever in a state where the second unlock mechanism is not pushing the unlock lever.

**5**. The seat slide apparatus for a vehicle according to claim **2**, wherein the second unlocked state release mechanism remains at a position where the second unlocked state release mechanism does not interfere with the unlocked state retaining lever at a time of the operational input at the operation lever in a state where the second unlock mechanism is not pushing the unlock lever.

**6**. A seat slide apparatus for a vehicle, comprising:
- a lower rail configured to be retained on a floor portion of the vehicle;
- an upper rail configured to retain a seat, the upper rail configured to move relative to the lower rail;
- a lock mechanism configured to restrain movement of the upper rail relative to the lower rail;
- a first unlock mechanism including an unlock lever making rotational movement in response to an operational input

at an operation lever, the first unlock mechanism operating the lock mechanism to unlock by the rotational movement of the unlock lever;

a second unlock mechanism making the unlock lever rotationally move in a direction that unlocks the lock mechanism by pushing the unlock lever in accordance with a predetermined seat operation;

an unlocked state retaining lever configured to retain the lock mechanism in an unlocked state cooperating with the second unlock mechanism by operating in conjunction with the second unlock mechanism to move to a position where the lock mechanism is retained in the unlocked state;

a first unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from being retained in the unlocked state by making contact with an operation body in accordance with movement of the upper rail relative to the lower rail; and

a second unlocked state release mechanism moving the unlocked state retaining lever to a position where the lock mechanism is released from being retained in the unlocked state by pushing the unlocked state retaining lever in accordance with the operational input,

wherein the predetermined seat operation is an operation to knock down a seat back in a frontward direction.

**7**. The seat slide apparatus for a vehicle according to claim **1**, wherein the predetermined seat operation is an operation to knock down a seat back in a frontward direction.

**8**. The seat slide apparatus for a vehicle according to claim **2**, wherein the predetermined seat operation is an operation to knock down a seat back in a frontward direction.

**9**. The seat slide apparatus for a vehicle according to claim **1**, wherein

the second unlock mechanism includes a second unlock lever pushing the unlock lever by making rotational movement in response to the predetermined seat operation, wherein

the unlocked state retaining lever retains the lock mechanism at a position where the lock mechanism is in the unlocked state by making rotational movement in conjunction with movement of the second unlock lever and engaging with the second unlock lever, and wherein

the second unlocked state release mechanism pushes the unlocked state retaining lever to move rotationally to a position where the unlocked state retaining lever disengages from the second unlock lever.

**10**. The seat slide apparatus for a vehicle according to claim **2**, wherein

the second unlock mechanism includes a second unlock lever pushing the unlock lever by making rotational movement in response to the predetermined seat operation, wherein

the unlocked state retaining lever retains the lock mechanism at a position where the lock mechanism is in the unlocked state by making rotational movement in conjunction with movement of the second unlock lever and engaging with the second unlock lever, and wherein

the second unlocked state release mechanism pushes the unlocked state retaining lever to move rotationally to a position where the unlocked state retaining lever disengages from the second unlock lever.

**11**. The seat slide apparatus for a vehicle according to claim **1**, wherein the first unlocked state release mechanism includes the unlocked state release lever making rotational movement integrally with the unlocked state retaining lever by the first end of the unlocked state release lever coming into contact with the operation body to rotationally move the unlocked state retaining lever to a position where the unlocked state retaining lever disengages from a second unlock lever.

**12**. The seat slide apparatus for a vehicle according to claim **2**, wherein the first unlocked state release mechanism includes an unlocked state release lever making rotational movement integrally with the unlocked state retaining lever by a first end of the unlocked state release lever coming into contact with the operation body to rotationally move the unlocked state retaining lever to a position where the unlocked state retaining lever disengages from a second unlock lever.

**13**. The seat slide apparatus for a vehicle according to claim **1**, wherein the second unlocked state release mechanism is configured with the unlock lever to push the unlocked state retaining lever to rotationally move the unlocked state retaining lever to a position where the unlocked state retaining lever disengages from a second unlock lever.

**14**. The seat slide apparatus for a vehicle according to claim **2**, wherein the second unlocked state release mechanism is configured with the unlock lever to push the unlocked state retaining lever to rotationally move the unlocked state retaining lever to a position where the unlocked state retaining lever disengages from a second unlock lever.

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